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ABSTRACT

This book is a teacher's resource guide designed to help students gain the range of math skills they need to succeed in life, work, and on standardized tests; overcome math anxiety; discover math as interesting and purposeful; and develop good number sense. Topics covered in this book include algebra and geometry. Lessons are organized around four strands: (1) skill lessons that present instruction and practice in math skills including computation and solving word problems; (2) tools lessons emphasizing the use of objects such as calculators or concepts such as estimation, all within real-life contexts; (3) problem solving lessons designed to strengthen estimation and reasoning skills and help students build strategies for solving single and multi-step problems; and (4) application lessons that provide practice with realistic situations that require mathematics. (Author/KHR)

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Formerly *Smart Solutions*

Math Sense

Algebra and Geometry

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Teacher's Resource Guide

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MATH SENSE

Skills, Problem Solving, Tools, and Applications

TEACHER'S RESOURCE GUIDE

Algebra and Geometry

Jan Phillips and Kathy Osmus

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Answer Key 75

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Casio *fx*-260 image courtesy of Casio, Inc.

Unit 1

The Basics of Algebra

Unit Overview

The purpose of this unit is to give students a strong foundation in the basics of algebra. Students will develop the skills they need to effectively use expressions, variables, and simple formulas to solve problems. A strong start here will help prepare students for more complex algebra and geometry problems.

When Do I Use Algebra? page 13

Discuss what students think algebra means and what it involves. When students have expressed their ideas, ask them to check the situations at the top of the page that apply to them. Then have students read through problems 1–4 and decide which ones they could find a specific answer for (arithmetic) and which ones are general situations (algebra).

Talk About It page 13

Discuss students' answers to problems 1–4. Ask students to solve problems 1 and 4. Then ask why problems 2 and 3 cannot be solved as they are. For problem 2, ask if students could solve it if they knew Carlos earned $1,000 a month or $1,600 a month. For problem 3, ask, *"What would you need to know to find the amount of the tip? Would it matter if the bill was a different amount each time?"* Explain that algebra is flexible and applies to many situations.

Working Together page 53

Have students choose two problems. One of their choices should involve using other materials, such as newspapers and encyclopedias. After they solve the problems, compare answers. Discuss students' roles in approaching the problem.

Activity Overview

To find general information about *Math Sense*, including scope and sequence charts, see www.math-sense.com.

Student Book Lesson	Pages in SB	Pages in TRG	Activity Type	PCM Number
Writing Expressions	14	4	Reasoning/Cooperative Learning	1
Powers and Roots	16	4	Communication	2
Order of Operations	18	5	Hands-On/Calculator Practice	
Perimeter and Area	20	5	Hands-On/Cooperative Learning	
The Number Line	22	6	Hands-On	
Adding and Subtracting Signed Numbers	24	6	Making Connections	3
Multiplying and Dividing Signed Numbers	26	7	Calculator Practice	4
Expressions and Variables	28	7	Reasoning	5
Substitution	30	7	Making Connections	
Finding Patterns in Algebra	32	8	Cooperative Learning	6
Gridding in Answers	34	8	Grid Activity	7, 8
Simple Formulas and Substitution	38	9	Reasoning	
Using a Calculator	40	9	Calculator Practice/Real-Life	9
The Distributive Property	42	10	Reasoning	
Simplifying Expressions	44	10	Reasoning	
Scientific Notation	46	11	Reasoning	10
Celsius and Fahrenheit Thermometers	48	11	Real-Life	
Writing a Number Sentence	50	12	Cooperative Learning	

Writing Expressions

SB p. 14

Lesson Objectives

- write expressions based on words
- recognize when to use the four basic operations

Activity

Working with Expressions

Purpose: reinforce the ideas in the lesson

Materials

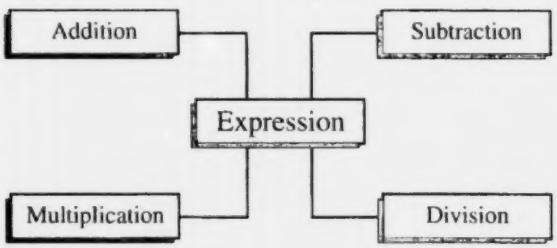
- PCM 1: List of Expressions, p. 41
- flip chart pages
- markers
- tape

What to Do

Explain that arithmetic expressions are a mathematical shorthand for word phrases.

Have students work in pairs or small groups. Give each group a flip chart page and marker.

Ask each group to write *Expression* in the center of the page. Then have them draw and label four branches from the center word, one for each of the four operations.



Distribute a copy of PCM 1 to each group. Tell students to write an arithmetic expression for each of the problems. As students write their expressions, have them place each expression under the appropriate branch on their chart.

Use the first problem to model this activity. (The expression, \$40 − \$12, belongs under the subtraction branch on the chart.) Encourage students to use parentheses or multiplication dots for multiplication and fraction bars for division.

Allow time for the groups to complete the charts. Then tape the charts on the wall for discussion and comparison. Ask students to explain their reasoning.

What to Look For

As students write their expressions, you may need to offer help in these areas:

- correct order of numbers in subtraction
- correct order of numbers in division
- correct operation choice

A discussion of how students view the problem may help.

Powers and Roots

SB p. 16

Lesson Objectives

- become familiar with and use powers and roots
- use perfect squares to estimate square roots

Activity

I Have, Who Has?

Purpose: reinforce the ideas in the lesson

Materials

- PCM 2: I Have, Who Has?, p. 42
- index cards
- calculators

What to Do

This activity will help students distinguish between powers and roots. It promotes good listening skills and improves students' mental math abilities.

Cut out the question-and-answer lines found on PCM 2 and attach each one to an index card. Shuffle the cards and distribute all the cards to students. Some students may have more cards than others. Tell students they may use calculators if they wish.

Any student may begin the activity by reading, "Who has ____ ?" from a card. The student whose card has the answer should respond by reading aloud, "I have ____. Who has ____?" The student who began the activity will have the answer to the final question asked.

Order of Operations

SB p. 18

Lesson Objectives

- learn the order of operations
- use the order of operations to evaluate expressions

Activity

Calculators and Order of Operations

Purpose: introduce the ideas in the lesson

Materials

- calculators, including one scientific calculator
- SB pp. 18–19

What to Do

Give each student a calculator. If necessary, model the following examples of entering one-step problems.

43 + 89 =	132.
75 − 28 =	47.
93 × 8 =	744.
965 ÷ 5 =	193.

To begin exploring the order of operations, ask students to find and write down the answer to this problem without using the calculator: $2 + 3 \times 4$

List their answers on the board (possible student answers: 20, 14, 24). Ask students, *"Can you explain your answer? Which one is correct?"* (14 is correct.)

Now have students use their calculators to solve the problem. Have one student use a scientific calculator. Compare answers. Most calculators will give 20 as the answer; a scientific calculator will show 14. Ask students why the scientific calculator gives a different answer. Someone may suggest that it multiplies before adding. Explain that the scientific calculator is programmed with the order of operations so it multiplies before adding.

Ask students, *"What if you want someone to add first before multiplying? How can you show someone that's what should be done?"* [Use parentheses: $(2 + 3) \times 4$]

Discuss the rules for the order of operations. You could ask students to work in small groups to create a mnemonic device to help them remember the order of operations as shown on student book page 18. They could write a phrase that uses the initial letters of **G**rouping symbols/**P**owers and **R**oots/**M**ultiplication and **D**ivision/**A**ddition and **S**ubtraction.

Some suggested problems to practice are listed here. Invite students to the board to explain how to solve the problems. Encourage discussion.

$12 - 5 - 3$; $4 \cdot 5 + 6 \cdot 3$; $4 \cdot 3^2$; $12 - (5 - 3)$; $18 - 4 \cdot 2$; $\frac{19 - 3 + 2}{7(2 + 1)}$

(Answers are 4; 38; 36; 10; 10; $\frac{6}{7}$)

Allow students to use calculators to check their work on problems 1–15 on student book page 19.

Perimeter and Area

Application

SB p. 20

Lesson Objectives

- find the perimeter of a figure
- find the area of a figure
- decide when to use perimeter or area

Activity

Exploring Perimeter and Area

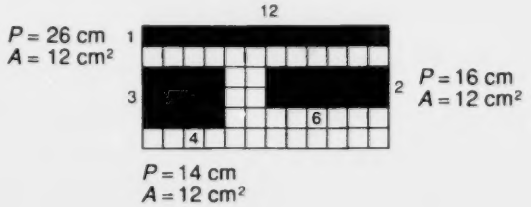
Purpose: explore the ideas in the lesson

Materials

- blank overhead graph paper transparency and marker
- graph paper

What to Do

To explore the relationships between the area and perimeter, draw the following figures on the overhead transparency to show different figures that have an area of 12 square units.



Distribute graph paper to each student. Ask them to draw as many squares and rectangles as possible with the areas listed below. Tell students to use only whole-number lengths and widths. Students should label the lengths and widths of their squares and rectangles.

16 square units	(1 × 16, 2 × 8, 4 × 4)
20 square units	(1 × 20, 2 × 10, 4 × 5)
7 square units	(1 × 7)
9 square units	(1 × 9, 3 × 3)
18 square units	(1 × 18, 2 × 9, 3 × 6)

Have students compare their drawings with a partner. Discuss how the lengths of sides are labeled. Ask, *"Why is it necessary to label only one side of a square?"* (because all four sides are the same length); *"Why is it necessary to label only two sides of a rectangle?"* (because opposite sides are the same length).

Students should find the perimeter of each figure. Discuss differences in perimeters of figures with the same areas.

The Number Line

Tools

SB p. 22

Lesson Objectives

- compare numbers by using a number line
- explore positive and negative numbers
- use comparison symbols
- find absolute value

Activity

Comparing Signed Numbers

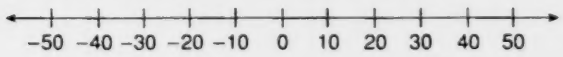
Purpose: reinforce the ideas in the lesson

Materials

- self-stick removable notes

What to Do

Draw a very long number line on the blackboard. It should be labeled as the one below is.



Distribute one or more self-stick notes to each student. Ask them to write a positive or negative number from −50 to 50 on each note. (You may want to write some numbers yourself to assure variety.)

Students should place their self-stick notes in the appropriate location on the number line.

Then let students select pairs of numbers from the self-stick notes and use <, >, and = to compare them. Ask students to summarize what happens to the size of numbers as you move to the right on a number line. (The numbers get larger as you move right.) Ask what happens as you move left. (The numbers get smaller.)

Adding and Subtracting Signed Numbers

SB p. 24

Lesson Objectives

- add numbers with the same sign
- add numbers with different signs
- subtract signed numbers

Activity

Using Negative Numbers

Purpose: reinforce the ideas in the lesson

Materials

- PCM 3: Negative Numbers in Your Life, p. 43

What to Do

Let students work in pairs. Distribute a copy of PCM 3 to each pair. (Cut PCMs 3 and 4 apart before photocopying to allow students room to write their examples.) Have them read through each situation and use negative numbers as instructed.

After students complete problems 1–4 on PCM 3, encourage them to write some examples based on situations in their own lives. Be sure they include mathematical sentences that represent the examples. Then have volunteers share some of their examples with the class.

Multiplying and Dividing Signed Numbers

SB p. 26

Lesson Objectives

- learn rules for multiplying and dividing signed numbers
- multiply and divide signed numbers
- apply the order of operations

Activity

Order of Operations and Signed Numbers

Purpose: extend the ideas in the lesson

Materials

- PCM 4: Working with Signed Numbers, p. 43
- calculators, with at least one having a [+/−] key

What to Do

Distribute a copy of PCM 4 to each student. Explain that they are going to practice the order of operations in working with signed numbers. Model the first problem for students:

$3 + 4(-2)$ [Multiply first: $4(-2) = -8$, then add: $3 + (-8) = -5$]

After students complete the exercise, have them use a calculator to check their answers. Explain that many calculators have a [+/−] key. Tell students that pressing the [+/−] key changes the sign of the number displayed on the calculator. Demonstrate how to use this key with problem 1 from the PCM. On a calculator, multiply first: [4] [×] [2] [+/−] [=], then [+] [3] [=].

Expressions and Variables

SB p. 28

Lesson Objectives

- become familiar with and use variables
- write verbal expressions as algebraic expressions
- apply algebraic expressions to situations

Activity

Using Variables in Writing Rules

Purpose: reinforce the ideas in the lesson

Materials

- PCM 5: From the Specific to the General, p. 44

What to Do

Have students work in pairs. Distribute a copy of PCM 5 to each pair. Use the top portion of the PCM to demonstrate how specific examples can be generalized by a rule. Remind students that $C = \pi d$, where $\pi \approx 3.14$.

Discuss the filled-in example with students. You may also want to model the second problem. After students complete the worksheet, discuss answers as a group.

What to Look For

Many students fear algebra because it seems so abstract. This activity may encourage students to use abstract symbols to express real-life situations. Encourage students to base their situations on the descriptions of the operations, not on the number examples in the first column.

Substitution

SB p. 30

Lesson Objectives

- substitute values to solve expressions
- write and solve expressions

Activity

Expressions from Graphs

Purpose: reinforce the ideas in the lesson

Materials

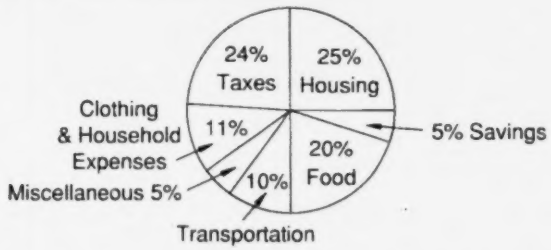
- index cards
- blank overhead transparency and marker

What to Do

Distribute an index card to each student. Ask each student to write a hypothetical yearly income on the card (for example, $20,000; $75,000; $14,000; etc.).

Ask students to keep their amounts under $100,000 and to round the amounts to the nearest $1,000.

On a blank transparency or blackboard, draw an approximate version of the circle graph shown below. Tell students that a circle graph can represent 100% of someone's income. Deductions, expenses, and savings are shown as percentages of total income. Review how to change a percent to a decimal. In this example, taxes would be .24.



Students may choose to create new circle graphs by using their own expenses and tax rates.

Ask students to develop algebraic expressions based on the circle graph. Their expressions should show the relationship between income and the percentages on the graph. Let I represent income.

Examples: Miscellaneous $.05I$

Taxes $.24I$

Have students exchange index cards with a partner and use the income figure on the card and the algebraic expressions developed from the circle graph to calculate the dollar amounts of the expenses. Ask students to discuss their results.

Finding Patterns in Algebra

Problem Solver

SB p. 32

Lesson Objectives

- recognize patterns in number series
- use patterns to solve problems

Activity

Representing Patterns with Equations

Purpose: explore the ideas in the lesson

Materials

- PCM 6: Using Algebra to Describe Patterns, p. 45
- scissors
- index cards
- tape

What to Do

Have students work in small groups. Give a copy of PCM 6 and 38 index cards to each group.

Have the groups copy each statement from the PCM onto an index card and thoroughly shuffle the cards. Ask students to sort the statements on the cards, putting together those that have similar characteristics [for example, $2 \cdot 2 = 2^2$ and $(.9)(.9) = (.9)^2$], without looking at the PCM. Display the similar statements in groups around the classroom.

Then have students develop algebraic equations to describe the patterns. Model one group. For example, the group that contains $6 + 0 = 6$ could be represented by the equation $n + 0 = n$.

Gridding in Answers

Tools

SB p. 34

Lesson Objectives

- evaluate expressions using the order of operations
- fill in algebra answers on a five-column grid

Activity

Find the Value

Purpose: reinforce the ideas in the lesson

Materials

- PCM 7: Five-Column Grids, p. 46
- PCM 8: Find the Value, p. 47
- scientific calculators such as the Casio *fx*-260 (optional)

What to Do

Distribute copies of PCM 7 and PCM 8 to each student. Review the order of operations including grouping symbols (parentheses and fraction bars), squares, and square roots. Remind students that operations above and below a fraction bar should be treated as though they are enclosed in parentheses.

Using PCM 8, students should evaluate each expression three times using the given values. Have them record their answers in the grids on PCM 7.

Remind students that the five-column grid cannot be used to grid in negative numbers; therefore, each answer must be positive.

For additional calculator practice, have students check their work using scientific calculators. Students will need to use parentheses skillfully to enter the entire expression at once. Some students may prefer to work only parts of the expression using a calculator while using mental math or paper and pencil to work the remaining part(s).

What to Look For

As students grid in numbers, check grids for accuracy. You may want to discuss strategies for using mental math to do the work more quickly. Make sure students do not place commas in gridded answers.

Using the Casio *fx*-260 for the GED

The change sign key [+/−] is located in the first column of the upper block of keys on the Casio calculator. To enter a negative number, first enter the number, then press [+/−]. For example, to enter –2, press [2] [+/−].

Simple Formulas and Substitution

SB p. 38

Lesson Objectives

- use formulas
- use substitution to solve formula problems

Common Difficulties

Students may have trouble making the generalizations necessary to understand and manipulate formulas. Use questions like this one to open discussion: *"Using multiplication and division equations, how can you show that three times four equals twelve?"* ($12 \div 4 = 3$ or $12 \div 3 = 4$ or $4 \cdot 3 = 12$)

Activity

Manipulating Equations

Purpose: introduce the ideas in the lesson

What to Do

Give students these instructions:

"Write three equations using only the numbers five, seven, and twelve." ($5 + 7 = 12$, $12 - 5 = 7$, $12 - 7 = 5$)

"Write three equations using only the numbers thirty-five, five, and seven." ($35 \div 5 = 7$, $5 \cdot 7 = 35$, $35 \div 7 = 5$)

Explain that the first example shows that addition and subtraction are inverse operations. The second example demonstrates that multiplication and division are inverse operations. If necessary, review the definition of *inverse operation.*

Using the equations that students have just written, model how to generalize the equations by using algebra. For example:

$5 + 7 = 12$	$12 - 5 = 7$	$12 - 7 = 5$
$x + y = z$	$z - x = y$	$z - y = x$
$35 \div 5 = 7$	$5 \cdot 7 = 35$	$35 \div 7 = 5$
$\frac{z}{x} = y$	$xy = z$	$\frac{z}{y} = x$

Explain to students that they can extend this manipulation to common formulas.

Using a Calculator

Tools

SB p. 40

Lesson Objectives

- use a calculator to solve expressions
- use a calculator to solve formula problems

Activity

Evaluating Formulas

Purpose: reinforce the ideas in the lesson

Materials

- PCM 9: Formulas in Your Life, p. 48
- calculators and grocery store flyers

What to Do

Have students work in pairs or small groups. Distribute flyers, a calculator, and a copy of PCM 9 to each student. Encourage students to evaluate the formulas both on paper and with a calculator.

Mention that problem 5 uses simple interest so they can practice with the interest formula. Be sure students realize that commercial loans use compound interest and that a borrower pays more when compound interest is used.

When students are finished, have them exchange PCMs and solve each other's problems.

Then ask volunteers to demonstrate how they solved each problem. Discuss the answers. Ask, *"Does your answer make sense? Did you estimate?"*

The Distributive Property

SB p. 42

Lesson Objective

- discover and apply the distributive property

Activity

Exploring the Distributive Property

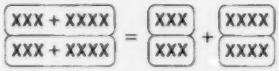
Purpose: introduce the ideas in the lesson

Materials

- blank overhead transparency and marker

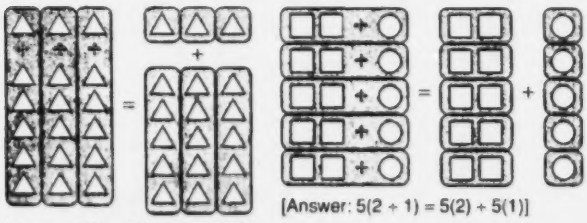
What to Do

Explain that students will be working with the distributive property. Lead them through this example:



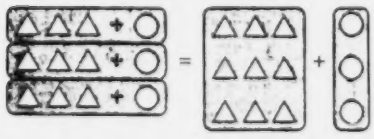
$2(3 + 4) = 2(3) + 2(4)$

After discussing the example, write the following problems on a transparency on an overhead projector:



[Answer: $3(1 + 5) = 3(1) + 3(5)$]

[Answer: $5(2 + 1) = 5(2) + 5(1)$]



[Answer: $3(3 + 1) = 9 + 3$]

Have students write a mathematical statement to describe the distributive property being shown. Then review students' statements.

Expansion/Reinforcement: Allow time for students to create their own sketches and statements that show the distributive property. Ask students to share their examples with the class.

Simplifying Expressions

SB p. 44

Lesson Objective

- write, simplify, and solve expressions

Activity

Applying the Distributive Property

Purpose: reinforce the ideas in the lesson

Materials

- SB p. 44

What to Do

Review the expressions in part A on student book page 44. Ask volunteers to show how they could use the distributive property to simplify the expressions.

Examples:

1. $5x - 2x = x(5 - 2) = 3x$
4. $2a + 9a - 9 + 6 =$
   $a(2 + 9) - 3 =$
   $11a - 3$
7. $k + m - 2k - 9m =$
   $k - 2k + m - 9m =$
   $k(1 - 2) + m(1 - 9) =$
   $k(-1) + m(-8) =$
   $-k - 8m$

Have students test the validity of their work by substituting values for the variables in the exercises. Point out that the expressions should have the same value both before and after applying the distributive property.

Scientific Notation

Application

SB p. 46

Lesson Objectives

- write large numbers in scientific notation
- evaluate expressions written in scientific notation

Activity

Small Numbers and Scientific Notation

Purpose: extend the ideas in the lesson

Materials

- PCM 10: Extended Place Value Chart, p. 49
- calculators

What to Do

After working through the lesson, have students describe what all of the numbers they worked with have in common. (They are large numbers.) Explain that scientific notation can also be used to express very small numbers.

Distribute a copy of PCM 10 to each student. Review the place value chart. Discuss how the chart is extended to the right of the decimal point by using the pattern begun in the whole numbers.

Give students the following examples to demonstrate how to write small numbers in scientific notation:

$.000056 = 5.6 \times 10^{-5}$

$.0004 = 4.0 \times 10^{-4}$

Have students complete problems 1–6 on the PCM.

Then explain that it can be tricky to multiply very small or very large numbers on a calculator. Give students this example:

$.0000056 \times .007$

Have students try the calculation on a calculator. Some displays will show zero or *E*. The *E* indicates that the display does not contain enough digits to show the answer.

Using this example, explain how to solve a problem with very small numbers on a calculator. First, multiply 56×7. Then count the number of zeros in the problem and add that number of zeros before the first digit in the product. ($56 \times 7 = 392$; add 7 zeros before the 3: .0000000392)

Tell students they can use a similar approach to multiply very large numbers. They should add the total number of zeros after the last digit in the product.

Have students complete the problems on PCM 10. Discuss any questions students have as they check their answers.

Expansion/Reinforcement: Tell students that scientific calculators use scientific notation to display very small and very large numbers. Demonstrate with the example used earlier: $.0000056 \times .007$. The calculator display will show 3.92 –08, which equals 3.92×10^{-8}. This is equal to the answer found earlier: .0000000392.

Celsius and Fahrenheit Thermometers

Tools

SB p. 48

Lesson Objectives

- convert from Celsius to Fahrenheit
- convert from Fahrenheit to Celsius

Activity

Converting Temperatures

Purpose: extend the ideas in the lesson

Materials

- newspaper charts reporting high and low temperatures in different cities

What to Do

Have students work in pairs or small groups. Distribute newspapers reporting recorded high and low temperatures to each group. Have students select five different cities and convert the high and low temperatures for the given day. If the temperatures are in Fahrenheit, have students convert them to Celsius. If the temperatures are in Celsius, have students convert them to Fahrenheit.

Students should be able to tell if their conversions are reasonable based on other students' selections and converted temperatures.

Writing a Number Sentence

Problem Solver

SB p. 50

Lesson Objectives

- understand verbal expressions translated into math symbols
- relate mathematical sentences to words and pictures

Activity

Finding Mystery Numbers

Purpose: extend the ideas in the lesson

What to Do

The mystery numbers activity requires solving problems and writing equations and problems. Tell students the activity consists of thinking of a number, creating a clue (a verbal expression) about the number, exchanging clues, writing an equation, and finding the mystery number.

Model the activity on the board using the following examples:

1. *"I'm thinking of a number. The difference between the number and four is eleven. What's the number?"* ($n - 4 = 11, n = 15$)
2. *"What number squared less nine equals twenty-seven?"* ($n^2 - 9 = 27, n = 6$)
3. *"Fourteen is five more than half this number. What number is it?"* ($14 = 5 + \frac{n}{2}, n = 18$)

Ask each student to think of a number and write a clue for it on paper. Have students exchange clues with a partner. Students should write a number sentence for the clue they receive, using a variable to represent the mystery number. Then have them solve the number sentence.

Students can use estimation to check their answers. You may want to repeat this activity. Encourage creative problem solving. Be sure students have time to share their answers.

Unit 2

Putting Algebra to Use

Unit Overview

The purpose of this unit is to give students the opportunity to apply their knowledge of algebra and their problem-solving skills. Students will use formulas, ratios, and proportions to evaluate several types of problems, including word problems.

How Do I Use Algebra? page 55

Have students complete the checklist. Students may have written expressions and equations that differ from the answers given. Discuss students' answers to be sure that they have the same meaning and value as the sample answers.

Talk About It page 55

As you discuss the similarities and differences among students' answers, have students look closely at what distinguishes an expression from an equation. Have students talk about what further information they would need in order to solve items 1–4.

Working Together page 91

Have the class choose one activity for the class period. Students should complete the activity in pairs or small groups. Move around the classroom as students work, answering any questions they have. Once the groups have completed the activity, have them compare and discuss answers with other groups.

Activity Overview

To find general information about *Math Sense*, including scope and sequence charts, see www.math-sense.com.

Student Book Lesson	Pages in SB	Pages in TRG	Activity Type	PCM Number
Solving Equations	56	14	Reasoning/Hands-On	
Addition and Subtraction Equations	58	14	Mental Math	11
Multiplication and Division Equations	60	14	Mental Math	12
Equations and Multiple Operations	62	15	Real-Life	13
Simplifying Equations	64	15	Reasoning/Cooperative Learning	14
Using Substitution	66	16	Real-Life	15
Using Formulas	68	16	Making Connections	
Solving Inequalities	70	16	Hands-On	
Gridding in Algebra Answers	72	17	Grid Activity	7
Lists and Diagrams	76	18	Making Connections	
Algebra Word Problems	78	18	Making Connections	16
Percents and Equations	82	19	Real-Life	
Using Ratio	84	19	Cooperative Learning/Real-Life	
Using Proportion	86	19	Making Connections	17
Different Ways to Solve Problems	88	20	Reasoning	18

Solving Equations

SB p. 56

Lesson Objectives

- manipulate formulas and equations
- write and solve equations
- use the area formula

Activity

Creating Equations

Purpose: reinforce the ideas in the lesson

Materials

- rulers, yardsticks, tape measures (optional)

What to Do

Tell students they will be working with the area formula. Each student should measure a rectangular object in the room. If measuring tools are not available, students can estimate the measurements. Students should round their measurements or estimates to the nearest whole number.

After students have gathered their measurements, have each student draw a rough sketch of the object measured. Tell students they are going to exchange sketches with a partner. However, they first need to decide which measurements to provide with the sketch and which measurement to have their partner find. For example, a student who measured a rectangular desk 6 feet long and 4 feet wide could provide the area and length: $A = 24$ ft.^{2}; $l = 6$ ft. The partner would then find the width.

Tell students to write and solve an equation for the problem they receive. Partners should check each other's work.

Addition and Subtraction Equations

SB p. 58

Lesson Objective

- use inverse operations to solve equations and word problems

Activity

Solving Equations I

Purpose: reinforce the ideas in the lesson

Materials

- PCM 11: Solving Equations I, p. 50

What to Do

Distribute a copy of PCM 11 facedown to each student. Explain that this is a timed exercise, and tell them how long they will have to complete it. Only the answers may be written on the paper. All work should be done mentally by using inverse operations. (*Note:* Fill in the answers on your own copy of PCM 11 to create an answer key.)

Time the students. (Students should be able to complete the exercise in two to four minutes.) Then read the answers so students can check their work. Answer any questions students have. The test can be repeated to improve mental math skills and scores.

Ask students to save their copies of PCM 11 for comparison during the next activity.

Multiplication and Division Equations

SB p. 60

Lesson Objectives

- use inverse operations to solve equations
- use the cost formula to find unit price

Activity

Solving Equations II

Purpose: reinforce the ideas in the lesson

Materials

- PCM 12: Solving Equations II, p. 50
- students' copies of PCM 11 filled out in previous activity

What to Do

Follow the guidelines for the previous activity. After students check their answers, have them discuss whether one type of problem seemed easier to solve

mentally: multiplication or division. Then have students compare the addition and subtraction problems from PCM 11 to the problems on PCM 12. Ask, *"Which set of problems seemed easier for you to solve mentally? Why do you think this is so?"*

Students should become much more confident in their mental math abilities after working through these exercises.

Equations and Multiple Operations

SB p. 62

Lesson Objectives

- solve multistep problems
- write and solve equations with multiple operations

Activity

Clara's Cafe

Purpose: apply the ideas in the lesson

Materials

- PCM 13: Clara's Cafe Sponsors a Softball Team, p. 51

What to Do

Have students work in pairs. Distribute a copy of PCM 13 to each pair. Have a volunteer read the first paragraph aloud.

Explain that for problems 1–5, there is a list of equations they can use in solving the problems. Students may select an equation from the list as a first step in solving each problem. Ask pairs to explain their choices and their solutions.

For problem 6, let students be creative, write their own equations, and describe their solutions to the rest of the class.

Simplifying Equations

SB p. 64

Lesson Objectives

- simplify equations by combining terms
- use the distributive property

Activity

Simplifying, Step by Step

Purpose: reinforce the ideas in the lesson

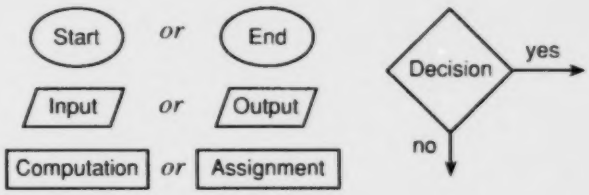
Materials

- PCM 14: A Step-by-Step Approach, p. 52

What to Do

Discuss flowcharts and how they show a step-by-step approach to problem solving.

The box symbols used in flowcharts are shown here. Write the symbols on the board so students can discuss and refer to them.



Distribute a copy of PCM 14 to each student. Discuss as a group the Order of Operations Flowchart provided on the handout. Then have students work individually to solve problems 1–3.

After reviewing these problems, discuss how to make a flowchart for the steps in solving an equation. Let students work in small groups to make their flowcharts. The flowcharts should include the following steps:

1. If there are parentheses, use the distributive property.
2. Combine like terms on each side of the equation.
3. Use inverse addition and subtraction operations so variables are on one side and numbers are on the other.

4. Use inverse multiplication and division operations to solve for the variable.

5. Check the solution in the original equation.

Students should test their flowcharts by solving problems 4–6 on PCM 14.

Using Substitution

SB p. 66

Lesson Objectives

- substitute to solve equations with more than one variable
- manipulate formulas

Activity

Retail Discounts

Purpose: extend the ideas in the lesson

Materials

- PCM 15: Retail Discounts, p. 53
- calculators

What to Do

Distribute a copy of PCM 15 to each student and discuss the formulas provided. During the discussion, have students talk about how these equations are related. Have students write in words what each formula means. Point out that some of the formulas can be substituted in other formulas to solve a problem.

Have students work in pairs to fill in the chart. Tell them they can use a calculator for their calculations. After they complete the chart, ask students to compare answers with other pairs. Ask volunteers to present their solutions to the class.

Using Formulas

Tools

SB p. 68

Lesson Objectives

- rewrite formulas to find different variables
- substitute values to evaluate equations

Activity

Who Uses Formulas?

Purpose: reinforce the ideas in the lesson

Materials

- SB p. 68

What to Do

Review the formulas on student book page 68. On the board, list the main types of formulas as headings (see list below). Leave room under each heading.

As a group, discuss different jobs or professions that might require the use of these or other formulas.

List students' responses under the correct headings. Encourage students to give as many answers as possible. Sample headings and answers are given here:

- Perimeter (fence salesperson, tailor, picture framer)
- Area (carpet salesperson, painter, architect, real-estate agent, landlord)
- Cost (consumer; people working in retail sales: clerk, manager, buyer)
- Distance (truck driver, messenger, pilot, delivery person, travel agent)
- Interest (banker, borrower, credit card user or company, mortgage loan officer)
- Mean (budget analyst, statistician)
- Temperature (weather reporter, importer or exporter of goods, traveler)

Solving Inequalities

SB p. 70

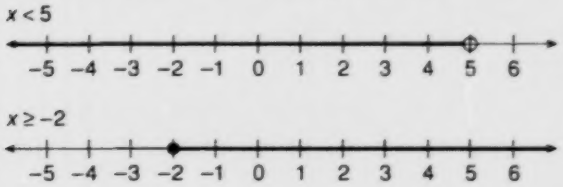
Lesson Objectives

- simplify inequalities
- solve inequalities

Common Difficulties

Students may have difficulty with problems that have a range of correct answers. Graphing the solutions to an inequality can help. On the following number lines, an open circle shows that the value does *not*

fall within the range of correct answers. The filled-in circle shows that the value *is* a possible solution.



Activity

Working with Inequalities

Purpose: apply the ideas in the lesson

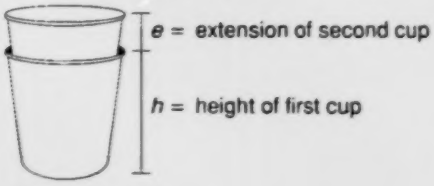
Materials

- Styrofoam cups
- rulers

What to Do

Tell students that they are to determine how many Styrofoam cups can be stored in one stack in a cabinet that measures 27 inches tall. Ask, *"How many cups will fit in a stack?"*

Display several stacks of two cups so that each student has access to a stack. Ask, *"What measurements will you need to solve the problem?"* (Students need to measure the height of the entire first cup and the part of the second cup that extends above the rim of the first cup when the cups are stacked.)



Ask students, *"How do you find the height of a stack of three cups?"* ($h + e + e = h + 2e$) *"ten cups?"* ($h + e + e + e + e + e + e + e + e + e = h + 9e$) *"n cups?"* [$h + e(n - 1)$]

Ask, *"Using the dimensions of these cups, how many cups will fit in a stack in the cabinet? What inequality can you use to solve the problem?"* [$h + e(n - 1) < 27$]. Have students assign values to the variables and solve the inequality.

Ask, *"Can n be a decimal answer? What must be done to solve the problem?"* (*n* is a number of whole cups; round down to a whole number.)

Discuss why they must round down in this situation. Ask, *"Why is rounding necessary?"* (A fraction of a cup can't be stored.) Ask, *"What would happen if you rounded up?"* (The stack could be one cup too tall.)

Gridding in Algebra Answers

Tools

SB p. 72

Lesson Objectives

- fill in algebra answers on a five-column grid
- create problems based on formulas

Activity

Choose the Correct Formula

Purpose: reinforce the ideas in the lesson

Materials

- PCM 7: Five-Column Grids, p. 46
- index cards (nine per pair of students)

What to Do

In this activity, students will work in pairs to write and solve nine word problems using the first nine formulas on page 68 of their book. Have students write a word problem on one side of an index card and its answer on the other side. Encourage students to think of real-life situations where each formula might be used—for example, framing a picture or calculating miles per hour. A problem should not state which formula will be needed to solve it. If necessary, students should include directions to round to a particular decimal place.

After students have completed the task, collect the cards and choose nine problems randomly. Read the problems aloud and have students solve and grid the answers on PCM 7. After students finish filling in the grids, discuss their solutions as a class.

Save the remaining cards to use as a problem bank for a quick review when time allows.

What to Look For

As students fill in numbers, check grids for accuracy. Students may have trouble creating situations for a particular formula. They may use the problems in the student book on pages 69 and 75 as models.

Lists and Diagrams

Tools

SB p. 76

Lesson Objectives

- use lists and expressions to represent parts of a problem
- use diagrams to show action in word problems

Activity

Look at It Another Way

Purpose: extend the ideas in the lesson

Materials

- SB p. 76

What to Do

Have students work in pairs. Ask each pair to choose one of the problems in part B on student book page 76. Have students solve the problem they choose by assigning x to the other person in the problem. For example, in problem 3 let Luba's age be x. Ask, *"What would Anna's age be?"* ($x - 3$)

After students solve their problem, have them compare their answers to those in the student book answer key. Ask, *"Did you get the same ages for each person? Why?"* (The answers are the same because the relationship between the two values stays the same. Luba is always 3 years older than Anna, whether Luba's age is shown as $x + 3$ or Anna's as $x - 3$.)

Algebra Word Problems

Problem Solver

SB p. 78

Lesson Objectives

- apply algebra to everyday situations
- apply problem-solving strategies

Common Difficulties

There is often more than one way to solve a word problem. If students get a correct answer by using a process other than the one shown in the answer key, discuss the different ways of getting the same answer.

Activity

How Long Has It Been?

Purpose: explore the ideas in the lesson

Materials

- PCM 16: How Long Has It Been?, p. 54
- calculators
- calendar (optional)

What to Do

Distribute a copy of PCM 16 to each student. Students can work individually or in pairs. Listed below are two projects to describe and discuss. The necessary information for Project 1 is provided on PCM 16. Information needed for Project 2 is presented here.

Project 1: Students will calculate the exact number of days they have been alive. After they use their calculators to find the answer, let students work together to develop a formula for the process.

Here's one possible formula: $E = 365A + L + 1 + D$, where A = age, L = number of leap years, D = number of days since your last birthday, and E = exact number of days you've been alive.

Project 2: Students are leaving today for Mars in a space vehicle that travels at an average speed of 500 miles per hour. Students are to find the month, day, and year they would arrive on Mars if the trip is about 35 million miles. Have students use a calculator (and possibly a calendar). Then ask them to write a formula to find the number of days needed to travel to another planet.

Here's one possible formula: $E = \frac{D}{R} \div 24$, where D = distance in miles to the planet from Earth, R = average rate of speed per hour, and E = exact number of days the trip would take.

Point out that distance divided by rate will give them the time in hours. They must divide by 24 to find the time in days.

Percents and Equations

Application

SB p. 82

Lesson Objectives

- write percent equations
- solve percent problems

Activity

Percents in the Real World

Purpose: reinforce the ideas in the lesson

Materials

- several daily newspapers
- SB p. 82

What to Do

Distribute newspapers to each student. Ask students to scan the newspapers, looking for articles, ads, charts, graphs, or any information that uses percents. After they have selected some examples of percents, have each student write a problem that uses the percent information.

Encourage students to write problems that ask for the whole or the percent, not just the part. Then have students exchange problems and solve them, using the methods on student book page 82.

Using Ratio

Application

SB p. 84

Lesson Objectives

- write and simplify ratios
- solve ratio word problems
- calculate population density

Common Difficulties

Students sometimes think they are doing a problem wrong if they use more than one step to simplify a ratio or rate. Point out that taking more than one step is sometimes the easiest way to do the work.

Activity

Rates and Ratios

Purpose: explore the ideas in the lesson

Materials

- newspaper advertising flyers
- calculators

What to Do

Explain to students that rates are ratios that compare two types of units.

Examples:

55 miles per hour is $\frac{55 \text{ miles}}{1 \text{ hour}}$.

\$3.95 per pound is $\frac{\$3.95}{1 \text{ pound}}$.

19 miles per gallon is $\frac{19 \text{ miles}}{1 \text{ gallon}}$.

Ask, *"Can you think of other rates?"*

Say, *"A special use of rates is unit cost. Unit costs are ratios with a denominator of one."* Distribute advertising flyers to students as they work in small groups. Ask them to use a calculator to find the unit cost of various items in the flyers. For example, toothpaste that sells at 10.4 ounces for \$5.47 is $\frac{\$5.47}{10.4 \text{ oz}}$ = \$0.53 per ounce ($\frac{\$0.525}{1} \approx \frac{\$0.53}{1}$ or \$0.53 per ounce).

Ask volunteers to report on the items they selected and the unit price of each. Ask students, *"How does knowing unit cost help the consumer? Create a formula to show unit cost and the relationship among cost, number of units, and the price of each unit."* (sample formula: $\frac{c}{n} = r$, where c = cost, n = number of units, and r = rate or price of each unit)

Using Proportion

Application

SB p. 86

Lesson Objectives

- solve proportions by using cross multiplication
- use proportions to solve word problems

Activity

A Balanced Proportion

Purpose: reinforce the ideas in the lesson

Materials

- PCM 17: Using Ratio and Proportion, p. 55

What to Do

Let students work in pairs. Distribute a copy of PCM 17 to each pair. (Cut PCMs 17 and 18 apart before photocopying to allow students room to write their problems.) Discuss as a group the different types of math problems that can be solved by using ratio and proportion. Ask, *"What do all ratio and proportion problems have in common?"* (a standard rate. For example, 826 bricks per 14 feet of wall can be used to calculate other amounts based on the same rate.) *"How can you recognize ratio and proportion problems?"* (A rate is given.)

Have students continue to work in pairs to solve problems 1–8 on PCM 17. Then ask each pair to develop four new problems similar to those on PCM 17. Have each pair choose two of their problems for the class to solve.

Different Ways to Solve Problems

Problem Solver

SB p. 88

Lesson Objectives

- use different methods to solve problems
- compare equations and proportions as problem-solving methods

Activity

Using More than One Approach

Purpose: investigate the ideas in the lesson

Materials

- PCM 18: The Italian Restaurant, p. 55

What to Do

Distribute a copy of PCM 18 to each student. (Cut PCMs 17 and 18 apart before photocopying to allow students room to work the problem.) Give students at least five minutes to solve the problem independently. Then have them pair up to discuss different problem-solving methods. Encourage pairs to find at least two methods. After sufficient time, ask students to share their problem-solving techniques and their answers with the class. Applaud creative methods and persistence.

Unit 3

The Basics of Geometry

Unit Overview

The purpose of this unit is to give students a strong foundation in the basics of geometry. Students will be introduced to geometric terms, such as *point, line,* and *angle,* and geometric properties, such as a square's having four equal sides and four right angles. Students will also work with units of measure and learn how to use measuring tools.

How Do I Recognize Geometry? page 93

Review the list of words at the top of the page. Answer any questions students have about the meanings of the words. After students have read through the sentences listed and placed check marks, discuss the sentences they checked.

Talk About It page 93

Have volunteers give mathematical examples of as many of the words from the list as possible. Here's a sample answer: "The *opposite* sides of the rectangle are the same length." Students should be able to explain their examples. They may also use a drawing as a visual example of the term. Encourage students to give more than one example for the same term.

Working Together page 119

Before beginning the activities, discuss how to determine what types of measuring tools are needed for each. Then provide tools as necessary. You may wish to model each of the activities for students. Refer students to the lesson on pages 102–103 of the student book, "Changing Units of Measure," for metric equivalents.

Activity Overview

To find general information about *Math Sense*, including scope and sequence charts, see www.math-sense.com.

Student Book Lesson	Pages in SB	Pages in TRG	Activity Type	PCM Number
Points, Lines, and Angles	94	22	Communication/Cooperative Learning	
Protractors	96	22	Hands-On	
Pairs of Angles	98	23	Reasoning	19
Rulers, Yardsticks, and Tape Measures	100	23	Hands-On/Cooperative Learning	
Changing Units of Measure	102	24	Real-Life	20
Gridding in Geometry Answers	104	24	Grid Activity	7
Properties of Quadrilaterals	108	25	Hands-On	
Properties of Circles	110	26	Reasoning	21
Properties of Triangles	112	26	Reasoning	22
The Pythagorean Theorem	114	27	Hands-On	23
Understanding Maps	116	27	Hands-On	24

Points, Lines, and Angles

SB p. 94

Lesson Objectives

- learn basic geometric terms
- distinguish different types of angles

Activity

Know Your Facts

Purpose: reinforce the ideas in the lesson

Materials

- SB pp. 94–95

What to Do

After a thorough discussion of the vocabulary and descriptions on student book pages 94 and 95, have students close their books. Then use the following game to review the information.

1. Have students work individually. Give them two minutes to list and describe in words or pictures what they remember from the vocabulary discussion.
2. After students complete their lists, have them work in pairs. Allow two more minutes for partners to compare lists. They should compile the two lists into one.
3. Next, form the class into two teams, keeping pairs together. Give the teams two minutes to compile their lists.
4. Finally, bring both teams together to compare lists. A team scores one point for each item it has that the other team does not.

Protractors

SB p. 96

Lesson Objectives

- use a protractor to measure angles
- name angles
- solve problems with angles

Common Difficulties

Students sometimes neglect to line up one ray of an angle they are measuring along the baseline of the protractor. Another common error is reading the wrong scale on the protractor.

Activity

Angles and Protractors

Purpose: investigate the ideas in the lesson

Materials

- paper circles
- scissors

What to Do

Have students work in pairs. Tell students that they are going to construct their own protractors.

1. Distribute one paper circle and scissors to each pair of students. They should fold the circle in half and cut along the diameter to form two semicircles.
2. Have each student fold a semicircle in half to find the centerpoint of the baseline and to create a 90° mark. Have them write *90°* at the top of the fold.
3. Have students continue folding their semicircles to identify 45° and 135°, 30° and 60°, and 120° and 150°. Students should label the angles (folds) as they make them. Remind them to label 0° and 180° as well. If students need help folding 45° and 135° angles, have them fold each 90° angle in half. If students need help folding angles of 30°, 60°, 120°, and 150°, have them fold each 90° angle in thirds.
4. Have students use the protractors they made to estimate the size of angles in the classroom. Discuss such questions as *"Do the lengths of the sides of an angle affect the size of the angle?"* (No.)

What to Look For

Students may be unfamiliar with the term *diameter.* Have students deduce and describe what *diameter* means after they fold the circle in half.

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Pairs of Angles

SB p. 98

Lesson Objectives

- identify complementary and supplementary angles
- identify adjacent and vertical angles
- use angles to solve problems

Activity

Putting It All Together

Purpose: extend the ideas in the lesson

Materials

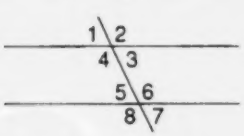
- PCM 19: Putting It All Together, p. 56
- scissors

What to Do

The three angles of a triangle provide an example of angle relationships. The sum of the three angles is 180°. Students can discover this themselves.

1. First ask students how many degrees make up a straight line or angle (180°). Then have students draw and cut out a triangle. Tell them to tear the triangle into three parts, each part containing an angle. Have students arrange the angles together along a straight edge, such as the edge of a desk. The three angles will form a straight angle of 180°.

2. Extend the discussion to include corresponding angles formed when parallel lines are intersected by a straight line. Review the meaning of *parallel lines* (lines on the same plane or flat surface that never meet or intersect). Now sketch the following illustration on the board.



Point out angles 2 and 6 as an example of corresponding angles. Then have students list as many additional pairs of corresponding angles as they can. ($\angle 3$ and $\angle 7$, $\angle 1$ and $\angle 5$, $\angle 4$ and $\angle 8$)

3. Distribute copies of PCM 19. Ask students to use facts 1–5 on PCM 19 to identify the measures of all the angles in the diagram.

Rulers, Yardsticks, and Tape Measures

Tools

SB p. 100

Lesson Objective

- use linear units of measure from the English and metric systems

Activity

Scavenger Hunt

Purpose: apply the ideas in the lesson

Materials

- rulers, yardsticks, and tape measures
- scavenger hunt lists
- prizes (rulers, pocket calendars, and so on)

What to Do

Divide the class into groups of three or four students. Each group needs a ruler, a yardstick, a tape measure, and a copy of the scavenger hunt list below.

Measuring Scavenger Hunt List

- the height of each person in the group
- the diameter of a button
- the length of the shortest foot in the group
- the length of the longest foot in the group
- the length and width of the classroom
- the length of a pencil
- the length of a paper clip
- the width of a staple
- the thickness of a book
- the thickness of a page

Give groups 20 minutes to find and measure the items on the list. You may want to add other items to the list as well. The winning group is the one with the most items correctly measured. You can award prizes. (*Note:* You may want to specify the button, pencil, paper clip, and book students will measure to simplify scoring.)

Discuss any difficulties students encountered in measuring items. What strategies did they use to measure the thickness of a page? (They could have found out how many pages made a 1-inch stack, then expressed the thickness of one page as a fraction of an inch.)

Changing Units of Measure

Problem Solver

SB p. 102

Lesson Objectives

- convert English units to larger or smaller English units
- convert metric units to larger or smaller metric units
- convert English units to metric units
- convert metric units to English units

Common Difficulties

Students may need guidance when working with different units in the same problem or converting between English and metric. You may want to model these types of problems. Encourage students to ask questions.

Activity

At the Machine Shop

Purpose: explore the ideas in the lesson

Materials

- PCM 20: At the Machine Shop, p. 57

What to Do

Discuss the uses of measurements in different occupations, such as carpet installer, plumber, mechanic, machinist, and so on.

Distribute a copy of PCM 20 to each student. Have students practice changing units of measure by solving these problems, which a person might face in a machine shop. Answer any questions students have. After they complete the handout, discuss their answers.

Gridding in Geometry Answers

SB p. 104

Lesson Objectives

- fill in geometry answers on a five-column grid
- convert linear measurements

Activity

Changing Units

Purpose: reinforce the ideas in the lesson

Materials

- PCM 7: Five-Column Grids, p. 46

What to Do

Remind the students that to receive credit for a gridded answer, they must write it in the measurement unit stated in the question. Explain that you are going to give the students nine answers and ask them to change the answers to a different measurement unit. They should then grid their answers on PCM 7. If they want, students may use page 236 of the Tool Kit to find common linear equivalents.

The answer is . . .	Change to . . .
1. $6\frac{1}{2}$ feet	inches
2. $12\frac{2}{3}$ yards	feet
3. 45 inches	feet
4. 54 inches	yards
5. 3 miles	feet
6. 1.75 meters	centimeters
7. 2.8 meters	millimeters
8. 345 centimeters	meters
9. 4.5 kilometers	meters

Answers:

1. 78	4. 3/2 or 1.5	7. 2800
2. 38	5. 15840	8. 3.45
3. 15/4 or 3.75	6. 175	9. 4500

What to Look For

Make sure students change mixed numbers to improper fractions or decimals before gridding their answers. Help students look for patterns in their work. They should see that they always use multiplication to change from a larger unit to a smaller one (for example, feet to inches). Likewise, they must use division to change from a smaller unit to a larger one (for example, inches to feet).

Properties of Quadrilaterals

SB p. 108

Lesson Objective

- identify common quadrilaterals and their properties

Activity

Tangrams

Purpose: extend the ideas in the lesson

Materials

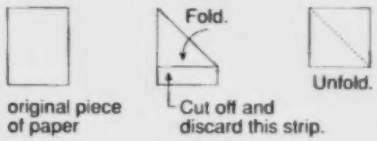
- $8\frac{1}{2}$-by-11-inch sheets of paper
- scissors

What to Do

A tangram is a puzzle that comes from China. The seven pieces of a tangram are called tans. In this activity, students will create the seven pieces by folding and cutting a sheet of paper. Students can then use these pieces to explore the different sizes and shapes of geometric figures and the similarities and differences between them.

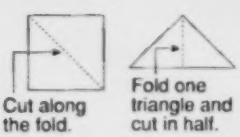
The Complete Tangram

Distribute sheets of $8\frac{1}{2}$-by-11-inch paper. Have students fold and unfold as shown to form the square paper they will use to make their tangrams. They should cut off and discard the rectangular strip from the bottom of the page. As they do this, discuss the properties of rectangles (opposite sides parallel and equal, four right angles) and squares (opposite sides parallel, all sides equal, four right angles).



Then have students follow these steps for making a tangram. You may want to model the steps for students as you go along.

1. *"Fold and cut the square into two large triangles."* Discuss the properties of triangles (three sides, sum of the three angles is 180°).
2. *"Fold one of these triangles in half, and cut it along the fold line."* Discuss the midpoint of the base and the height of a triangle.

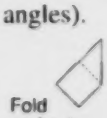


3. *"With the other large triangle, bring the point of the ninety-degree angle to the middle of the base and fold. Cut along the fold."*

4. *"Fold the larger piece in half, and cut along the fold."* Discuss the properties of a trapezoid (one pair of parallel sides, quadrilateral).

Fold and cut.

5. *"Fold one of the small pieces to form a square and a triangle, and cut it along the fold."* Discuss the properties of squares (four equal sides, four right angles).



Fold and cut.

6. *"Fold the other small piece to form a parallelogram and a triangle, and cut it along the fold."* Discuss the properties of a parallelogram (two pairs of parallel sides, opposite sides equal).

When students have their seven pieces, have them put the square back together again.

Properties of Circles

SB p. 110

Lesson Objectives

- identify properties of circles
- determine radius, diameter, and circumference
- determine lines of symmetry

Activity

Properties

Purpose: reinforce the ideas in the lesson

Materials

- PCM 21: Properties Worksheet, p. 58

What to Do

Discuss the properties of circles. Then distribute a copy of PCM 21 to each student. Call their attention to the Attributes Map in problem 3, and point out the four empty ovals. Explain that they will fill in the information indicated by the label below each oval: the value that represents the ratio of circumference to diameter and the formulas for diameter, radius, and circumference.

Have students work individually to fill in the PCM. Compare and discuss answers as a group.

Properties of Triangles

SB p. 112

Lesson Objectives

- identify properties of triangles
- identify different types of triangles

Activity

Identifying Triangles

Purpose: reinforce the ideas in the lesson

Materials

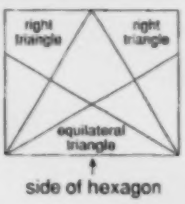
- PCM 22: How Many Triangles Do You See? p. 59

What to Do

Distribute a copy of PCM 22 to each student. Ask students to identify and count as many triangles as they can in the figure (72). Compare totals.

Then guide students in developing a strategy for using math to determine the total. Tell students to look for repeating patterns. For example, two adjacent sides of the hexagon and their diagonal form a block of 10 triangles:

This pattern repeats 6 times; however, 6 of the triangles would be counted twice when the pattern overlaps. You now have 54 triangles.



As shown above, 3 larger triangles are formed from each side of the hexagon: 1 equilateral and 2 right triangles. 6 sides × 3 triangles = 18 additional triangles. There are 72 triangles total (54 + 18 = 72).

The Pythagorean Theorem

SB p. 114

Lesson Objectives

- identify parts of a right triangle
- use the Pythagorean theorem
- discover Pythagorean Triples

Activity

Investigating the Pythagorean Theorem

Purpose: investigate the ideas in the lesson

Materials

- PCM 23: Investigating the Pythagorean Theorem, p. 60
- graph paper
- scissors

What to Do

This exercise will help students explore and visualize the relationship among the squares of the sides of a right triangle.

Distribute copies of PCM 23, graph paper, and scissors. Discuss the figure at the top of the page, focusing on how sides a, b, and c are related to a^2, b^2, and c^2.

Next have students explore an isosceles right triangle. Students can use graph paper as they follow the directions on the handout.

Understanding Maps

SB p. 116

Lesson Objectives

- practice reading maps
- find distances using a scale or legend

Activity

Working with Maps

Purpose: reinforce the ideas in the lesson

Materials

- PCM 24: Maps, p. 61
- state and local maps (with mileage markers along routes)
- rulers

What to Do

Have students work in small groups. Distribute a map, rulers, and a copy of PCM 24 to each group.

Discuss the various features of road maps, the legend, and the numbers that indicate mileage along routes.

Have students use the maps and rulers to answer the questions on the PCM. Circulate among the groups to answer any questions students have.

Unit 4

Using Geometry

Unit Overview

The purpose of this unit is to expose students to practical applications of geometry. Students will work with formulas for perimeter, circumference, area, volume, and cost. They will also learn to choose the appropriate formula for a given situation.

How Do I Use Geometry? page 121

Have students read through situations 1–8 and check the ones that they have worked with or think they could solve. Then have students discuss or write about two similar situations in their own lives.

Talk About It page 121

Have students discuss the differences between perimeter, area, and volume. Then discuss units of measure for perimeter (linear units), area (square units), and volume (cubic units). Talk about which units would be appropriate in situations 1–8 and also in the situations the students described.

Working Together page 151

Divide students into small groups, and assign one activity to each group. For activity 1, remind students to use the perimeter and area formulas on page 237 of their books. Provide paint cans and measuring tools to groups working on activity 2. For activity 3, have available cardboard, rulers, and scissors. When the groups have completed their work, discuss the activities as a class.

Activity Overview

To find general information about *Math Sense*, including scope and sequence charts, see www.math-sense.com.

Student Book Lesson	Pages in SB	Pages in TRG	Activity Type	PCM Number
Perimeter and Circumference Formulas	122	29	Hands-On	
Solving Complex Perimeter Problems	124	29	Reasoning/Calculator Practice	25
Area Formulas	126	30	Hands-On	
Solving Complex Area Problems	128	30	Cooperative Learning	26
Solid Figures	130	31	Real-Life/Hands-On	
Volume Formulas	132	31	Reasoning	27
Surface Area	134	31	Hands-On	
Gridding in Calculator Answers	136	32	Grid Activity	7, 28
Seeing Geometric Figures	140	32	Real-Life	
Choosing Perimeter, Area, or Volume	142	33	Reasoning	
Drawing a Picture	144	34	Hands-On	29
Renovating a Room	146	34	Hands-On/Real-Life	
Using the Cost Formula	148	34	Real-Life	

Perimeter and Circumference Formulas

Tools

SB p. 122

Lesson Objectives

- find the perimeter of rectangles, squares, and polygons
- find the circumference of circles
- use perimeter and circumference formulas

Activity

Look around You

Purpose: reinforce the ideas in the lesson

Materials

- rulers, tape measures, yardsticks
- SB p. 122

What to Do

Have students work in pairs. Distribute a ruler, a tape measure, and a yardstick to each pair. Ask them to select at least three objects in the classroom to measure and then find the perimeter or circumference. Students should make the fewest measurements needed for each object. They should then use the appropriate formula to find the perimeter or circumference.

Examples:

- frame around a bulletin board, picture, or blackboard
- frame around a clock
- molding around a wall or ceiling
- baseboard around a room
- the edge of a desk
- frame around a window or door

Encourage students to use the formulas provided on student book page 122. After students have calculated the perimeter of their chosen items, have volunteers share their experiences with the class. Ask, *"Did you use the perimeter formulas? What advantages are there to using formulas?"* (faster, less measuring, easier to do mental calculations) Ask students to suggest situations that require finding perimeter.

Solving Complex Perimeter Problems

SB p. 124

Lesson Objectives

- identify complex shapes
- calculate missing measurements
- find complex perimeters

Activity

From Point A to Point B

Purpose: reinforce the ideas in the lesson

Materials

- PCM 25: From Point A to Point B, p. 62
- rulers
- calculators

What to Do

Have students work in pairs. Distribute a ruler, a calculator, and a copy of PCM 25 to each pair. Review using the scale to find actual distance by finding the distance between *Start* and the corner of Fairfax and North Avenue (3.2 miles). Point out that the streets running north-south are parallel and that the distance between two adjacent north-south streets is .8 mile. Students can use this information to find the distance by multiplying: $.8 \times 4 = 3.2$ miles.

Give students the following directions. Tell them they may use calculators to solve these problems.

Without retracing your path, find

1. the length of the shortest route by road between the points labeled *Start* and *Finish*
2. the length of the bike path around the lake
3. the length of the bus route (the dotted line) from the starting point back to the starting point
4. the quickest way back to the point marked *Finish* if you get a flat tire at the corner of Blackhawk and Elm

Have students compare answers with other pairs when they finish.

Area Formulas

SB p. 126

Lesson Objectives

- use area formulas
- find areas of rectangles, squares, parallelograms, triangles, and circles

Activity

Discovering Area

Purpose: explore and extend the ideas in the lesson

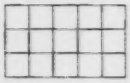
Materials

- 3-by-5-inch index cards
- rulers and scissors

What to Do

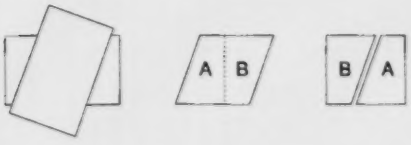
These activities are intended to help students explore areas of different geometric shapes. Have students work in pairs. Distribute five index cards, a ruler, and scissors to each pair. Give them these instructions.

1. Rectangle: *"Use one index card. Mark off inches along the edges of the card. Draw straight lines from each mark to the mark opposite to form a grid of square inches. Count the number of square inches to find the area of the rectangle."* (15 in.^{2})



$A = lw$
$A = 3 \times 5 = 15$

2. Parallelogram: *"Draw a parallelogram on an index card by holding another index card across it on a slant and marking the parallel sides. Cut out the parallelogram. Fold it perpendicular to the base. Cut along the height and rearrange the pieces to show $A = bh$."*



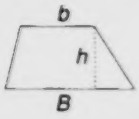
3. Triangle: *"Use one index card. Draw a line from one corner to the opposite corner. Cut along the line. Show that a right triangle is half of a rectangle. Talk about the base and height of a triangle."*

   Explain why $A = \frac{1}{2}bh$ for a triangle. (A triangle is half of a rectangle or a parallelogram. Therefore, the area of a right triangle is half of the area of a rectangle; the area of any other kind of triangle is half of the area of a parallelogram.)

4. Trapezoid: *"Use two index cards. Cut duplicate trapezoids from the two cards. Arrange the two pieces to form a parallelogram."*

   Then give students the formula for the area of a trapezoid: $A = \frac{1}{2}(b + B)h$. Using this figure, explain the formula.

Trapezoid



Solving Complex Area Problems

SB p. 128

Lesson Objectives

- identify the simple figures in complex shapes
- add and subtract areas of simple figures to find complex areas

Activity

Made in the Shade

Purpose: extend the ideas in the lesson

Materials

- PCM 26: Made in the Shade, p. 63
- flip chart pages and markers

What to Do

Have students work in pairs or small groups. Distribute a copy of PCM 26, flip chart pages, and markers to each group. Have each group select two figures from those on the PCM.

Students are to find the area of the shaded parts of the figures they chose. Allow them time to prepare their answers. On the flip chart page, they should

1. copy the figures
2. write the formulas they will use
3. find the areas of the shaded sections

After groups complete the assignment, display the flip chart pages around the classroom. Let students present their solutions to the class. Discuss any questions that may arise.

Expansion/Reinforcement: Have groups repeat the activity with one or two different figures, particularly figures not chosen by any group the first time.

Solid Figures

SB p. 130

Lesson Objectives

- find the volume of rectangular solids
- find the volume of cubes

Activity

It's All in the Volume

Purpose: reinforce the ideas in the lesson

Materials

- rulers, tape measures, yardsticks

What to Do

Review the properties of rectangular solids and cubes. Have students identify various solid shapes in the classroom. Then have students create a chart and assign each solid shape to a category. An example chart is given here:

rectangular solid	cube
box	box
cabinet	dice/number cubes
desk	blocks of various sizes
book	cube-shaped memo pads
door	
eraser	

Have students estimate the volumes of the objects they find. Discuss what measurements are necessary to find the exact volume.

Have students work in pairs. Distribute rulers, tape measures, and yardsticks to each pair. Have them find the exact volume of two objects. Discuss how their answers compare to their estimates.

Volume Formulas

Tools

SB p. 132

Lesson Objectives

- use volume formulas
- find volume of a rectangular solid, cube, and cylinder
- relate volume and capacity

Activity

Using Formulas

Purpose: reinforce the ideas in the lesson

Materials

- PCM 27: Using Formulas, p. 64

What to Do

Review the distinguishing characteristics of perimeter, area, and volume problems.

Have students work in pairs. Distribute copies of PCM 27 to each pair. Have them read through the problems and decide which formula is needed to solve each problem. Filling in the chart at the bottom of the PCM will help them plan how to solve each problem. Then have them solve the problems.

Allow pairs 20 to 30 minutes to do the exercise. Then invite volunteers to share their solutions. Discuss and compare the different methods used.

Surface Area

SB p. 134

Lesson Objectives

- understand surface area
- calculate surface area of a rectangular solid, cube, and cylinder

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Activity

Calculating Surface Area

Purpose: reinforce the ideas in the lesson

Materials

- cardboard boxes of various sizes
- sealed cans of various sizes (soups, vegetables)
- rulers and tape measures

What to Do

Have students work in pairs. Display boxes and cans for students to measure. Each pair should choose two objects to measure.

Have each pair write equations for the surface areas of the objects they have chosen. Their formulas should be similar to the following:

- Surface area of a rectangular solid: $2lw + 2wh + 2lh$
- Surface area of a cube: $6s^2$
- Surface area of a cylinder: $2\pi r^2 + 2\pi rh$ (using $2\pi r$ as the formula for circumference) or $2\pi r^2 + \pi dh$ (using πd as the formula for circumference).

Distribute rulers and tape measures. Then have the pairs use the equations to find the surface area of each object.

Gridding in Calculator Answers

Tools

SB p. 136

Lesson Objectives

- grid in decimals and fractions
- decide to use fractions or decimals to solve

Activity

Geometric Figures

Purpose: reinforce the ideas in the lesson

Materials

- PCM 7: Five-Column Grids, p. 46
- PCM 28: Geometric Figures, p. 65
- calculators

What to Do

Give each student a copy of PCM 7 and PCM 28. Explain that students are going to write problems for the class based on figures A–F on PCM 28. For example, *In cubic feet, what is the volume of Figure A?* Point out that the gridded answer can be entered in decimal form (17.5) or as an improper fraction (35/2). Students may use a figure more than once.

Ask for a volunteer to present a problem. Then ask the class to list the information needed to solve it. Each student should solve the problem using a calculator and enter the answer in the first grid on PCM 7. Students may refer to Tool Kit page 237 for a list of formulas. Continue until all grids are used.

Discuss: *When is it best to work with decimals? with fractions?*

Using the Casio *fx*-260 for the GED

When working with squares and square roots, students may want to use the x^2 and $\sqrt{\ }$ functions on the Casio calculator. To square a number, enter the number and press x^2. To find the square root of a number, enter the number, press SHIFT and x^2. For more information, consult Tool Kit page 239.

Seeing Geometric Figures

Application

SB p. 140

Lesson Objectives

- identify geometric shapes in everyday objects
- apply perimeter, area, and volume formulas to common objects

Activity

Geometry Trivia

Purpose: review the ideas in the lesson

What to Do

Have students work in pairs or small groups. Write the following brainteasers on the board or read them aloud to students. Tell students that the answers are

all geometric terms. Have the groups answer as many as they can. The winning team is the one with the most correct answers.

1. What building near Washington, D.C., is named after a polygon?
2. According to legend, what area in the Caribbean is known for mysterious disappearances?
3. It is good advice to look at a situation from all ____.
4. A baseball diamond is really a ____.
5. Name the chamber in an engine in which a piston moves.
6. Three characters in a soap opera were involved in a tragic love ____.
7. A fax is transmitted across telephone ____.
8. Where do many New Yorkers celebrate New Year's Eve?
9. The place where Main Street and Third Avenue cross is called an ____.
10. If you see the problem differently than I do, you must have a different ____ of view.

Answers:

1. Pentagon
2. Bermuda Triangle
3. angles
4. square
5. cylinder
6. triangle
7. lines
8. Times Square
9. intersection
10. point

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Choosing Perimeter, Area, or Volume

Problem Solver

SB p. 142

Lesson Objectives

- determine whether to find perimeter, area, or volume
- determine correct units of measurement
- apply formulas
- compare perimeter and area

Activity

What Kind of Problem?

Purpose: introduce the ideas in the lesson

Materials

- SB pp. 142–143

What to Do

Have students work individually. On a sheet of paper, have them write the column headings *Perimeter, Area,* and *Volume.* Ask students to read each situation (problems 1–7) on student book pages 142–143. They should take 5–10 minutes to determine whether they need to find the perimeter, area, or volume for each problem and then describe the situation under the appropriate column on their paper. For problem 1, students would write "installing molding" in the *Perimeter* column.

After students categorize each situation, have them complete the lesson in the student book. Then copy the three column headings on the blackboard or a flip chart. Survey the class for suggestions about which situations belong in each category. Ask for volunteers to explain their reasoning.

Then have students suggest at least three more situations for each column.

Drawing a Picture

Problem Solver

SB p. 144

Lesson Objectives

- draw pictures to help visualize problems
- work with scale drawings

Activity

Picture This

Purpose: reinforce the ideas in the lesson

Materials

- PCM 29: Picture This, p. 65
- graph paper
- rulers
- compasses

What to Do

Have students work in pairs. Distribute a copy of PCM 29, graph paper, a ruler, and a compass to each pair. Explain that each square on the graph paper represents one square unit.

Have students complete the PCM. Then compare answers as a group.

Renovating a Room

Application

SB p. 146

Lesson Objective

- apply geometry skills to room renovation

Activity

Draw It to Scale

Purpose: extend the ideas in the lesson

Materials

- $\frac{1}{4}$-inch graph paper
- rulers, yardsticks, tape measures
- SB p. 147

What to Do

Distribute graph paper (at least three sheets per student) and measuring tools. Students should use the graph paper to do problem 29 on student book page 147. Then have them measure furniture, desks, chairs, and cabinets and add them to the scale drawing.

Display students' scale drawings on the bulletin board. Discuss similarities and differences.

Have students save their drawings for use in the next lesson's activity, "It All Adds Up."

Using the Cost Formula

Application

SB p. 148

Lesson Objectives

- practice using the cost formula
- combine measurements and amounts to be purchased

Activity

It All Adds Up

Purpose: extend the ideas in the lesson

Materials

- students' drawings from problem 29, SB p. 147
- SB p. 148
- newspaper ads and flyers from building supply and hardware stores

What to Do

Have students work in pairs or small groups. Have them write problems based on the scale drawings they made in the previous activity. They should use the geometry they have learned and information from the ads and flyers to create problems similar to those that make up the table on student book page 148.

Write this sample problem on the board: "If a gallon of paint covers 480 square feet, how much will it cost to paint a 15-foot-by-20-foot room with 8-foot ceilings? How much will it cost if the room needs two coats?" Ask, *"What information do you need to solve the problem?"* (the cost of one gallon of paint)

Groups should find the answers to their own problems to make sure the problems are complete. Have groups exchange problems to solve. Then have them check the answers with the group that wrote the problems.

Unit 5

Combining Algebra and Geometry

Unit Overview

The purpose of this unit is to show students what powerful problem-solving tools algebra and geometry are when used together. Students will work with similar figures and proportions, explore the coordinate system, and graph equations.

How Can Algebra and Geometry Work Together? page 153

Have students read the first checklist and check the problems that they can solve. Then have them read the second checklist and check the items they have used in the past. Discuss how the last four items use coordinate scales. Have students list other examples of coordinate scales that they see daily.

Talk About It page 153

For the first question, have students discuss the differences between formulas and equations. Formulas are generalized equations that can be applied to multiple situations; the values change with each situation. Equations state that two specific parts are equal. Answers to the second question will vary.

Working Together page 181

Break the class into pairs or small groups to investigate these problems. Assign one problem to each group. After the groups have a chance to explore the problem thoroughly, have them present their results to the whole class. Encourage class discussion.

Activity Overview

To find general information about *Math Sense*, including scope and sequence charts, see www.math-sense.com.

Student Book Lesson	Pages in SB	Pages in TRG	Activity Type	PCM Number
Similar Figures	154	36	Reasoning	30
Using Proportion with Similar Figures	156	36	Hands-On/Real-Life	
Finding Missing Dimensions	158	37	Cooperative Learning	31
Equations and Geometric Figures	160	37	Reasoning	32
Setting Up Solutions	162	37	Reasoning	33
The Coordinate System	166	38	Hands-On	34
Distances on the Coordinate System	168	38	Real-Life	35
Making a Table of Patterns	170	38	Making Connections	36
Graphing Multistep Linear Equations	172	39	Reasoning/Cooperative Learning	37
Slope and Intercept	174	39	Hands-On/Real-Life	
Linear Equations and Graphs	176	40	Making Connections	38
Gridding in Answers on a Coordinate System	178	40	Grid Activity	39

Similar Figures

SB p. 154

Lesson Objectives

- identify similar figures
- use ratio to check for similarity

Activity

Investigating Similar Figures

Purpose: extend the ideas in the lesson

Materials

- PCM 30: Investigating Similar Figures, p. 66

What to Do

Have students work in pairs. Distribute a copy of PCM 30 to each pair. Have students investigate the relationships between the dimensions, perimeters, and areas of the similar figures on the PCM.

When students have had ample time to study the figures and compare shapes and measurements, discuss assumptions students may have made about similar figures.

Students should now know that similar figures have the same shape. Point out another important fact: In similar figures, the ratio of the dimensions equals the ratio of the perimeters. However, the ratio of the area is the square of the ratio of the dimensions. Ask, *"If the ratio of the dimensions of two similar figures is two to one, what is the ratio of the areas?"* (4:1) *"If the ratios of the dimensions of two similar figures is one to three, what is the ratio of the areas?"* (1:9).

Using Proportion with Similar Figures

SB p. 156

Lesson Objective

- use proportion to find missing measurements in similar figures

Activity

Design and Draw

Purpose: reinforce the ideas in the lesson

Materials

- graph paper

What to Do

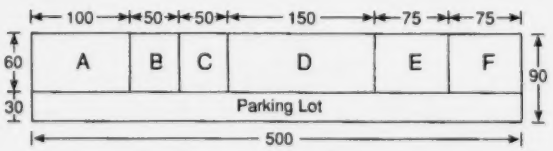
Have students work in pairs to design a shopping center. Distribute graph paper to each pair. Give students the following directions:

"Make a scale drawing of a small strip shopping center measuring forty-five thousand square feet. Each store is sixty feet from front to back. The parking lot in front of the stores is thirty feet from front to back. Each store and the parking lot will take up a fraction of the total square footage. Use the fractions to find the number of square feet the parking lot and each store will take up."

Copy the first two columns of the following table onto the blackboard or a flip chart for students to use.

Store/Lot	Fraction of total square feet	Answer
Parking Lot	$\frac{1}{3}$	(15,000 ft.^{2})
Store A	$\frac{2}{15}$	(6,000 ft.^{2})
Store B	$\frac{1}{15}$	(3,000 ft.^{2})
Store C	$\frac{1}{15}$	(3,000 ft.^{2})
Store D	$\frac{1}{5}$	(9,000 ft.^{2})
Store E	$\frac{1}{10}$	(4,500 ft.^{2})
Store F	$\frac{1}{10}$	(4,500 ft.^{2})

A sample solution is shown here. Some pairs may need to start by drawing a rectangle representing 90 × 500 feet to scale.



As a group, discuss how these ratios will determine each store's share of costs, such as maintenance

and property taxes. (The ratio of each store's costs will probably equal the ratio of its square feet to total square feet.)

Finding Missing Dimensions

Application

SB p. 158

Lesson Objectives

- find missing dimensions
- use formulas and dimensions to solve multistep problems

Activity

The Garden

Purpose: reinforce the ideas in the lesson

Materials

- PCM 31: The Garden, p. 67
- calculators
- flip chart pages
- markers

What to Do

Have students work in groups of three. Distribute a copy of PCM 31, a calculator, flip chart pages, and a marker to each group. Have students begin working on the PCM. Encourage them to develop their own garden plans to present to the class. Have them put their plans on flip chart pages and display them around the room. Discuss the perimeter of each section within the garden and how this could affect the cost of the garden (fencing, border plants, and so on). Ask, *"Are some gardens easier to manage than others? Is one design more attractive than another?"*

Equations and Geometric Figures

SB p. 160

Lesson Objectives

- use ratio and equations to find the measurements of angles
- use ratio and equations to find missing dimensions

Activity

Working with Figures

Purpose: explore the ideas in the lesson

Materials

- PCM 32: Working with Figures, p. 67

What to Do

Distribute a copy of PCM 32 to each student. Have students work individually. When they have completed the problems, ask students to work in pairs to check, discuss, compare, and if necessary, modify answers. Then go over the answers as a group. Let volunteers present their answers and explanations to the whole class.

Setting Up Solutions

Problem Solver

SB p. 162

Lesson Objectives

- set up solutions to problems
- choose the correct solutions to set-up problems

Activity

Matching Set-Up Solutions

Purpose: reinforce the ideas in the lesson

Materials

- PCM 33: Matching Set-Up Solutions, p. 68

What to Do

Distribute a copy of PCM 33 to each student. Have students work individually on the PCM. After completing the problems, they may compare and share answers. As a group, discuss the order of operations in each set-up solution.

Expansion/Reinforcement: Have students solve each setup for the missing variable.

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The Coordinate System

Tools

SB p. 166

Lesson Objectives

- learn coordinate system terms
- identify points on the coordinate system
- find the distance between points

Common Difficulties

When locating a point, students sometimes begin counting from a point other than the origin. Students will also confuse the x- and y-coordinates. Remind students that the x-coordinate is always listed first in an ordered pair.

Activity

Plotting Points and Finding Distances

Purpose: explore and extend the ideas in the lesson

Materials

- PCM 34: Plotting Points and Finding Distances, p. 69
- graph paper
- overhead transparency of the coordinate system (optional)

What to Do

Make an overhead transparency of PCM 34 or draw a coordinate system on the blackboard. Distribute copies of PCM 34 and graph paper to students. Use the coordinate system to discuss how to plot points. Then have students plot the points listed on the PCM. Copy the answers to Parts A and B from the answer key onto the transparency or blackboard. Discuss students' findings for Part C.

Distances on the Coordinate System

SB p. 168

Lesson Objectives

- use the coordinate system to find perimeter and area
- use the Pythagorean theorem with the coordinate system

Activity

Geometric Investigations

Purpose: reinforce the ideas in the lesson

Materials

- PCM 35: Geometric Investigations, p. 70

What to Do

Have students work in pairs. Distribute a copy of PCM 35 to each pair. Explain to students that they will use their understanding of the coordinate system to help them solve problems involving real-life objects. Allow sufficient time for students to explore and solve the problems on the PCM.

After they complete the PCM, ask volunteers to share their approaches, reasoning, and solutions.

Making a Table of Patterns

Tools

SB p. 170

Lesson Objectives

- find multiple solutions to an equation
- graph equations with multiple solutions

Activity

Tables, Patterns, and Graphs

Purpose: reinforce the ideas in the lesson

Materials

- PCM 36: Tables, Patterns, and Graphs, p. 71

What to Do

1. Distribute a copy of PCM 36 to each student. Tell students to read through each situation and complete the table. They should then write an equation that shows the constant relationship between the two values. Students may work in pairs, but each should make his or her own graph for each problem.

2. Have students compare tables, equations, and graphs to check their answers. Use the completed tables in the answer key and the coordinate graph on PCM 36 to create an answer key graph.

3. As a group, discuss students' tables, equations, and graphs.

Graphing Multistep Linear Equations

SB p. 172

Lesson Objectives

- graph a multistep equation
- check whether points are solutions to equations

Activity

Is a Picture Worth a Thousand Words?

Purpose: reinforce the ideas in the lesson

Materials

- PCM 37: Is a Picture Worth a Thousand Words?, p. 72

What to Do

Have students work in groups of three. Distribute a copy of PCM 37 to each group. Ask students to discuss the graphs. Have them discuss strategies for matching the graphs to the equations. (They could make a table of values for x and y or check whether a point on the line is a solution for a particular equation.)

Then have them match the graphs with the corresponding equations.

After the groups finish matching the equations to the graphs, have a class discussion about their selections and the reasoning behind their choices.

Slope and Intercept

SB p. 174

Lesson Objectives

- use a formula to calculate slope
- solve equations to find x- and y-intercepts

Common Difficulties

Students sometimes confuse the meaning of *rise* and *run*. To make the difference clear, ask *"What would you do if I asked you to rise?"* (Get up; move vertically.) *"What would you do if I asked you to run?"* (Move forward quickly; move horizontally.)

Activity

Raising the Roof

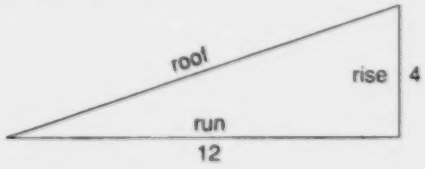
Purpose: expand the ideas in the lesson

Materials

- rulers
- graph paper
- photos of houses from newspaper real-estate sections or other publications (with pitch of roof clearly visible)

What to Do

Remind students that the slope of a roof is its pitch. As with any slope, the pitch of a roof is the ratio between the rise and the run. Draw the following example on the board.



slope = pitch

$\frac{\text{rise}}{\text{run}} = \frac{4}{12}$ = pitch of 4 in 12

Distribute graph paper and a ruler to each student. Have students sketch the following pitches: 7 in 12, 9 in 12, and 5 in 3. The graph paper will help students make sure the rise is perpendicular to the run.

Students should make sure their sketches are proportional. For example, if a student used inches for feet in the first problem, the rise would be 7 inches and the run 12 inches. Ask, *"How else could you draw a pitch of seven in twelve using inches?"* (Students could draw a rise of $3\frac{1}{2}$ inches and a run of 6 inches.)

After students have sketched the various pitches, discuss which roofs have the steepest slope. Ask, *"What kind of house would have a roof with a pitch of five in three?"* (A-frame)

Have students work in small groups. Distribute photos of houses. Tell students to select pictures of five different houses or buildings. Students should then estimate which pitch each roof comes closest to 4 in 12, 7 in 12, 9 in 12, or 5 in 3. Students should be able to support their estimates.

Linear Equations and Graphs

Application

SB p. 176

Lesson Objectives

- find multiple solutions to common formulas
- work with graphs of common formulas

Common Difficulties

Students who draw a line after finding only two points may graph an equation incorrectly. Finding a third point is the best way to check that the first two points were graphed correctly.

Activity

Linear Explorations

Purpose: reinforce the ideas in the lesson

Materials

- PCM 38: Linear Explorations, p. 73
- graph paper
- rulers

What to Do

Have students work in pairs. Distribute a copy of PCM 38, graph paper, and a ruler to each pair. Tell students that for each situation, they are to write expressions and equations as directed on the PCM. Then have them assign values to x (or y) and solve to create a table of possible values for the equation. Finally, they should graph the equation. Students should compare graphs when they are finished. Encourage discussion and questions about the activity.

Gridding in Answers on a Coordinate System

Tools

SB p. 178

Lesson Objective

- plot points on a coordinate grid

Activity

Plot the Missing Point

Purpose: extend the ideas in the lesson

Materials

- PCM 39: Plot the Missing Point, p. 74

What to Do

Give each student a copy of PCM 39. Explain that each problem lists a set of points that represents the vertices of a geometric figure. One point is missing. The students are also given the area of the completed figure. The students should determine where the missing point must be placed to complete a figure with the required area. Have them grid this point on one of the blank grids on PCM 39.

You may wish to give some or all of the following information as hints: problem 1 forms a square, problem 2 forms a rectangle, problems 3 and 4 form triangles, and problems 5 and 6 form parallelograms.

More than one answer may be possible if students choose to create an irregular figure.

What to Look For

Check for accuracy in marking grids. Students may find it helpful to lightly mark the location of the given points and then determine the location of the missing point. Remind them that they must erase any stray marks completely when taking a test.

PCM 1

List of Expressions

Write an expression for each of the following statements. Then write each expression under the correct operation on the chart you created.

1. Because of the sale, I paid \$12 less than the original price of \$40.
2. Each of 6 employees contributed \$5 for a gift certificate.
3. Jack and 4 friends agreed to split the \$2,000 prize if they won.
4. If your total bill for a raincoat is \$103.68, including \$7.86 in tax, what was the actual purchase price of the coat?
5. What is the sum of 84 and the next odd number?
6. How far can I drive at 55 miles per hour in $6\frac{1}{2}$ hours?
7. Your yearly insurance premium of \$376 can be paid quarterly.
8. What will it cost for each bagel at \$3.85 per dozen?
9. On average, 24 cars pass through the toll plaza every minute. How many pass through in an hour?
10. Marcie was happy about the 88¢ raise on her hourly wage of \$8.75.
11. How much more than \$3,500 is a \$4,275 down payment?
12. José doubled his \$18,000 salary when he took a new job.
13. If the total number of adult students is 1,860, what is the average number of students that will be in each of 65 classes?
14. If you pay \$20.00 for a \$17.58 purchase, how much change will you receive?
15. How many times faster is a car going 45 miles per hour than a man walking 2.5 miles per hour?
16. About $\frac{3}{4}$ of the 3,000 fans at a football game were cheering for the home team.
17. How many \$256 payments will it take to pay off a total of \$2,304?
18. My income is a combination of my \$32,000 yearly salary and \$6,500 profits from my investments.
19. How many $4\frac{1}{2}$-inch pieces can be cut from a board 1 yard long?
20. A plumber trimmed off $\frac{7}{8}$ inch from a 15-inch length of pipe.

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PCM 2

I Have, Who Has?

I have 30, who has 3^2?	I have 7, who has 3^3?
I have 8, who has $\sqrt{36}$?	I have 9, who has $\sqrt{144}$?
I have 16, who has $\sqrt{121}$?	I have 5, who has 5^2?
I have 64, who has 7^2?	I have 32, who has $\sqrt{900}$?
I have 125, who has $\sqrt{4}$?	I have 3, who has $\sqrt{25}$?
I have 20, who has 2^5?	I have 4, who has 11^2?
I have 2, who has $\sqrt{400}$?	I have 81, who has 4^2?
I have 121, who has 5^3?	I have 49, who has 6^2?
I have 12, who has 9^2?	I have 10, who has 8^2?
I have 6, who has $\sqrt{16}$?	I have 11, who has 10^2?
I have 36, who has 1^3?	I have 100, who has $\sqrt{9}$?
I have 27, who has $\sqrt{64}$?	I have 0, who has $\sqrt{49}$?
I have 1, who has 0^4?	I have 25, who has $\sqrt{100}$?

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PCM 3

Negative Numbers in Your Life

Read the following situations. Then write a math sentence using negative numbers that fits each situation.

1. On Monday morning, I rushed out of my apartment without checking to see how much money I had in my wallet. When I went to buy lunch, I was glad my friend was with me because my lunch bill was $5.75. I only had $2.80 on me. Write a math sentence to show how much I still owed. _____

2. I was on a diet last year. After three months, I had lost 17 pounds. Around the holidays, I gained back 7 pounds. At that point, I was still _____ pounds lighter than I was when I started the diet. I wanted to lose another 12 pounds. Write a number sentence to show how much less I will weigh when I finish my diet than when I started. _____

3. One night this winter, it was −2°F when I went to bed. The temperature dropped another 7° during the night. Write a mathematical sentence to show the temperature when I awoke in the morning. _____

4. My small investment last year lost $120. Since that time, it has gained about $56. What number sentence describes the status of my investment now? _____

Write two examples of times you have used negative numbers in your daily life.

PCM 4

Working with Signed Numbers

Use the order of operations to solve the following problems. Use a calculator to check your answers.

1. $3 + 4(-2) =$ _____
2. $4 - 2(-5) =$ _____
3. $2(-3) + 2(-5) =$ _____
4. $\frac{-4}{2} + \frac{8}{4} =$ _____
5. $5(-3 - 7) =$ _____
6. $12 - 6(2) =$ _____
7. $8 - 7^2 =$ _____
8. $5(-2) =$ _____
9. $-4(-6) + (-8)(-9) =$ _____
10. $-6 + 4 - 3 + 4 =$ _____
11. $-3 + (-8)(2) =$ _____
12. $-3(-8 + 2) =$ _____
13. $(-4)^2 =$ _____
14. $-14 - 3^2 =$ _____
15. $(-2 + 5)(-8 - 4) =$ _____
16. $-2 + 5(-8 - 4) =$ _____
17. $\frac{-9 - 5}{-6 - 1} =$ _____
18. $3(-4) + \frac{4(-2)}{2} =$ _____

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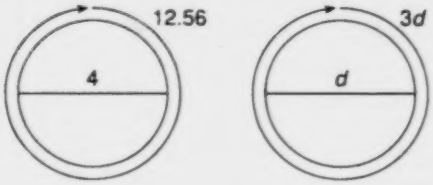
PCM 5

From the Specific to the General

Expressions are used to generalize a specific rule. For example, the circumference of a circle is about three times as large as its diameter. We can generalize this specific information by saying that, if the diameter is *d*, the circumference is approximately 3*d*.



Based on the specific examples below, write general rules using variables to describe the operations. The first one is done as an example.

Examples	Describe the operation in words.	Write a general rule using a variable.	Give a real-life example to match.
2(4) 2(5) 2(10) 2(12)	two times a number	2n	Rick saved twice his usual amount.
4^2 5^2 10^2 12^2			
4 – 2 5 – 2 10 – 2 12 – 2			
2 – 4 2 – 5 2 – 10 2 – 12			
4 + 2 5 + 2 10 + 2 12 + 2			
$\frac{4}{2}$ $\frac{5}{2}$ $\frac{10}{2}$ $\frac{12}{2}$			
$\frac{2}{4}$ $\frac{2}{5}$ $\frac{2}{10}$ $\frac{2}{12}$			

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PCM

6 Using Algebra to Describe Patterns

Copy each statement onto an index card and shuffle the cards. Without looking at this sheet, sort the statements into groups of similar characteristics. (Your groups should match the groups shown here.) Then write an algebraic equation on each blank line to describe the pattern in that group.

$5 \cdot 0 = 0$

$0 \cdot 3 = 0$

$(\frac{3}{4})(0) = 0$

$(.2)(0) = 0$

$0 \cdot 1 = 0$

_____

$9 \cdot 1 = 9$

$\frac{7}{8} \cdot 1 = \frac{7}{8}$

$(.6)(1) = .6$

$(1)(1) = 1$

$(-5)1 = -5$

_____

$2 \cdot 2 = 2^2$

$(-6)(-6) = (-6)^2$

$3 \cdot 3 = 3^2$

$\left(\frac{5}{6}\right)\left(\frac{5}{6}\right) = \left(\frac{5}{6}\right)^2$

$(.9)(.9) = (.9)^2$

_____

$4 \cdot 7 = 7 \cdot 4$

$\frac{3}{10} \cdot \frac{1}{3} = \frac{1}{3} \cdot \frac{3}{10}$

$(.4)(.6) = (.6)(.4)$

$(-5)(2) = (2)(-5)$

_____

$6 + 0 = 6$

$\frac{2}{3} + 0 = \frac{2}{3}$

$.25 + 0 = .25$

$72 + 0 = 72$

_____

$34 - 34 = 0$

$9.4 - 9.4 = 0$

$\frac{1}{4} - \frac{1}{4} = 0$

$5 - 5 = 0$

_____

$5 + 4 = 4 + 5$

$\frac{2}{5} + \frac{1}{4} = \frac{1}{4} + \frac{2}{5}$

$.6 + 1.3 = 1.3 + .6$

_____

$3 \cdot \frac{1}{3} = 1$

$\frac{7}{8} \cdot \frac{8}{7} = 1$

$7 \cdot \frac{1}{7} = 1$

$\frac{1}{2} \cdot 2 = 1$

_____

$\frac{14}{14} = 1$

$\frac{9}{9} = 1$

$\frac{.3}{.3} = 1$

$\frac{5}{8} \div \frac{5}{8} = 1$

_____

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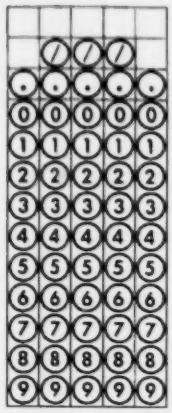
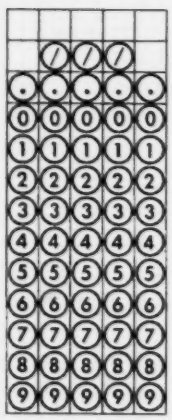
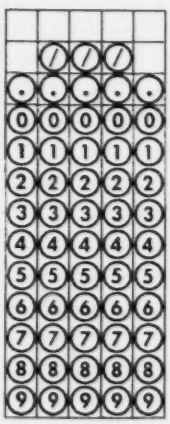
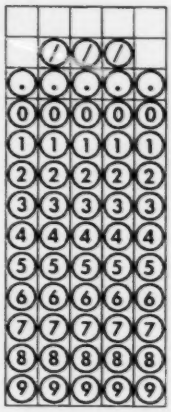
PCM 7

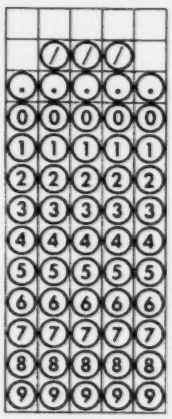
Five-Column Grids

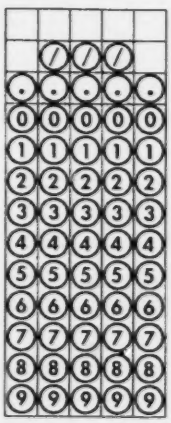
1. 

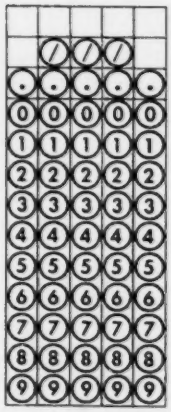
2. 

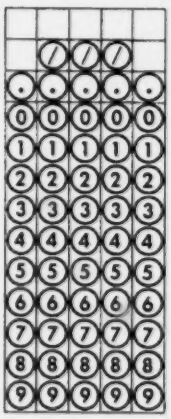
3. 

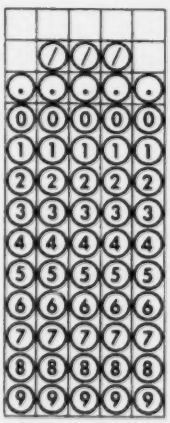
4. 

5. 

6. 

7. 

8. 

9. 

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8 Find the Value

For problems 1–3, evaluate the expression below by using the given values for *x*, *y*, and *z*.

$$\frac{2(x + y^2)}{z}$$

1. $x = 150$
$y = 5$
$z = 7$

2. $x = 84$
$y = 4$
$z = 8$

3. $x = -300$
$y = -6$
$z = -2$

For problems 4–6, evaluate the expression below by using the given values for *a*, *b*, and *c*.

$$900 - (3a - 2b) + 5c$$

4. $a = -14$
$b = 15$
$c = -4$

5. $a = 35$
$b = -45$
$c = -15$

6. $a = 240$
$b = 300$
$c = 125$

For problems 7–9, evaluate the expression below by using the given values for *p*, *q*, and *r*.

$$-2p \cdot \frac{1{,}200}{q + r}$$

7. $p = 16$
$q = 2$
$r = -5$

8. $p = 12$
$q = -40$
$r = -20$

9. $p = 5{,}600$
$q = -786$
$r = 186$

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PCM

9 Formulas in Your Life

Use the formulas given to solve the problems.

Unit Price

$P = \frac{c}{n}$
P = unit price
c = cost of item
n = number of units

1. Compare the unit prices of the items below.

Tasty Flakes 25 ounces for $2.39	Honey Chunks 10 ounces for $1.79
Toasted Oats 16 ounces for $1.72	Corny Flakes 18 ounces for $2.29

2. Look through the grocery store flyers. Compare unit prices of similar products you might buy.

Gas Mileage

$G = \frac{m}{g}$
G = gas mileage (miles per gallon)
m = miles driven
g = gallons of gas used

3. Find the miles per gallon for 324 miles driven and 18 gallons of gas used.

4. Use your own numbers to create a gas mileage problem.

Interest on a Loan

$I = prt$
I = amount of interest on a loan
p = principal
r = annual rate (expressed as a decimal)
t = time in years

5. Find the amount of interest for a $6,500 principal at 9% for 3 years.

6. Use your own numbers to create an interest problem.

Bowling Handicap

$H = .8(200 - A)$
H = handicap
A = average of 3 games below 200

7. Find your bowling handicap if you bowl games of 127, 167, and 198.

8. Use your own numbers to create a problem.

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PCM

10 Extended Place Value Chart

___ ,	___	___	___ ,	___	___	___ .	___	___	___	___	___	___
10^6	10^5	10^4	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}
1,000,000s	100,000s	10,000s	1,000s	100s	10s	1s	$\frac{1}{10}$s	$\frac{1}{100}$s	$\frac{1}{1,000}$s	$\frac{1}{10,000}$s	$\frac{1}{100,000}$s	$\frac{1}{1,000,000}$s

Write each number in scientific notation.

1. 0.00078

2. 0.00009

3. 0.00000564

Write out each number that is written here in scientific notation.

4. 2.7×10^{-5}

5. 9.34×10^{-3}

6. 6.0×10^{-4}

Use a calculator to perform these operations. Then write your answers in scientific notation.

7. .00006 × .0009

8. 8,700,000 × 2,800

9. 23,000 × 310,000

10. .00027 × .0059

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PCM
11 Solving Equations I

Use mental math to solve for the unknown in each equation. Write only the answers.

1. $n - 2 = 5$ _____
2. $x + 3 = 8$ _____
3. $8 - t = 2$ _____
4. $y + 7 = 0$ _____
5. $2 + c = 9$ _____
6. $4 + a = 1$ _____
7. $1 = x - 4$ _____
8. $5 = r - 7$ _____
9. $11 - x = 5$ _____
10. $13 - f = 1$ _____
11. $6 + m = 2$ _____
12. $p - 4 = 0$ _____
13. $3 + h = 9$ _____
14. $3 - s = 0$ _____
15. $v + 4 = 0$ _____
16. $z - 6 = 1$ _____
17. $3 + w = 5$ _____
18. $0 = n - 6$ _____
19. $0 = 5 - u$ _____
20. $9 - d = 3$ _____
21. $7 - l = 2$ _____
22. $9 + q = 1$ _____
23. $12 + x = 7$ _____
24. $s + 15 = 5$ _____
25. $y - 1 = 0$ _____
26. $4 - x = 1$ _____
27. $m - 7 = 3$ _____
28. $3 - k = -2$ _____
29. $4 + t = 2$ _____
30. $5 + f = -4$ _____

PCM
12 Solving Equations II

Use mental math to solve for the unknown in each equation. Write only the answers.

1. $3y = 6$ _____
2. $5x = 10$ _____
3. $4a = 12$ _____
4. $3q = 15$ _____
5. $4v = 16$ _____
6. $5w = 25$ _____
7. $4f = 0$ _____
8. $24 = 6k$ _____
9. $0 = 7g$ _____
10. $8z = 24$ _____
11. $27 = 9a$ _____
12. $6t = 18$ _____
13. $12 = 3q$ _____
14. $8 = 4x$ _____
15. $4h = 4$ _____
16. $\frac{x}{2} = 4$ _____
17. $\frac{a}{3} = 6$ _____
18. $\frac{1}{2}x = 7$ _____
19. $\frac{x}{3} = 0$ _____
20. $\frac{12}{t} = 4$ _____
21. $\frac{6}{m} = 2$ _____
22. $\frac{1}{2}x = 6$ _____
23. $\frac{x}{4} = 4$ _____
24. $\frac{1}{5}a = 6$ _____
25. $\frac{c}{2} = 10$ _____
26. $\frac{48}{8} = g$ _____
27. $\frac{1}{3}l = 4$ _____
28. $\frac{1}{4}t = 5$ _____
29. $\frac{y}{6} = 3$ _____
30. $\frac{m}{4} = 4$ _____

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PCM
13 Clara's Cafe Sponsors a Softball Team

Clara's Cafe has offered to sponsor a coed softball team. A sponsor pays many of a team's expenses. Fifteen players have registered to play on the team. Uniforms cost $28 each. The team registration fee for the softball league is $75. The players will bring their own softball gloves. Other equipment, such as bats at $42 each and softballs at $36 per dozen, will be furnished by Clara's Cafe.

Possible equations to use when solving problems 1–5.

$2x + 6 = 24$	$80 - 6x = 22$	$28x - 20 = 316$	$15x + 72 = 447$	$15x + 15 = 75$
$24 - 2x = 6$	$6x + 22 = 80$	$28x = 316 + 20$	$447 - 15x = 72$	$75 - 15x = 15$

Use the information above to solve the following problems. For problems 1–5, first choose an equation from the list of possible equations. Then solve. Round answers to the nearest whole number if necessary.

1. The sporting goods store offered a $20 discount on group orders for uniforms. With the discount, an order cost $316. How many uniforms did the group order?

2. How much money would each player have to chip in if the cafe paid only $15 of the registration fee?

3. If the team needed 2 new softballs for each game plus 6 backup softballs for the season, how many games could be played for $72 worth of softballs?

4. When the cafe found a lower price for the uniforms, it agreed to pay for every player's uniform and two dozen softballs. The cafe spent $447. How much did each uniform cost?

5. To kick off the season, Clara's Cafe hosted a pizza party for the team. The cafe served $22 worth of drinks and 6 pizzas. If the whole party cost $80, what was the average price of each pizza?

6. Clara's Cafe decided to pay $450 for team expenses. Describe three possible ways the team could spend this money.

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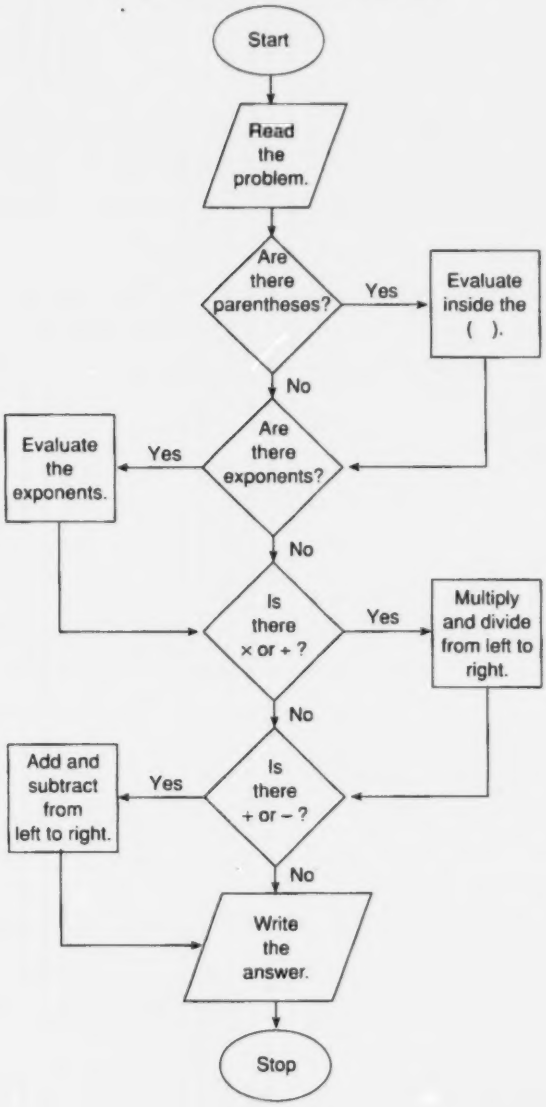
PCM
14 A Step-by-Step Approach

Order of Operations Flowchart



Solving an Equation Flowchart

Solve the following problems using the Order of Operations Flowchart.

1. $5 + 7 \times 8 - 3$

2. $5 + 7 \times (8 - 3)$

3. $5 + 7^2 \times 8 - 3$

Solve the following equations using your Solving an Equation Flowchart.

4. $5x - 15 = 2x$

5. $16 + 4z = 48$

6. $3(n + 2) - 6 = 27$

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PCM 15

Retail Discounts

The price a retailer puts on a price tag is called the marked price (m). Sometimes prices have to be reduced to keep the merchandise selling. This reduction is called a discount (d). The rate of discount (r) is a percent. The price a customer actually pays for the item is the selling price (s).

Discuss the following formulas based on the information above.
Write in words what each formula means.

1. $s = m - d$ _____

2. $d = rm$ _____

3. $r = \frac{d}{m}$ _____

4. $d = m - s$ _____

5. $m = \frac{s}{1 - r}$ _____

Use the formulas above to fill in the missing information on the sales chart below.

Item	Marked Price	Selling Price	Discount: Amount	Discount: Rate
Dress	$36.00			20%
Shoes	$27.50	$21.45		
Sport coat	$70.00	$61.25		
Sweater	$39.95			30%
Shirt	$17.75		$4.40	
Coat		$238.00		15%
Suit		$168.00		16%
Jewelry	$92.00		$41.40	

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16 How Long Has It Been?

Using your calculator, follow the steps below to find out how many days you've been alive.

- **Enter your age multiplied by 365.**
- **Count the number of leap years you've been alive. If you were born in a leap year on or before February 29, count that year. If this year is a leap year and it's after February 29, count this year.**

Leap Years

1904	1928	1952	1976	2000
1908	1932	1956	1980	2004
1912	1936	1960	1984	2008
1916	1940	1964	1988	2012
1920	1944	1968	1992	2016
1924	1948	1972	1996	2020

- **Add the number of leap years.**
- **Add 1 for your last birthday.**
- **Count the number of days since your last birthday. Do not count February 29 if this is a leap year.**

Days in a month

January, 31	May, 31	September, 30
February, 28	June, 30	October, 31
March, 31	July, 31	November, 30
April, 30	August, 31	December, 31

- **Add the number of days since your last birthday.**

Now write a formula for the steps you just followed.

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PCM 17

Using Ratio and Proportion

Solve the following problems by using ratio and proportion.

1. If 826 bricks are used to construct a wall 14 feet long, how many bricks are needed to construct a wall 35 feet long?
2. Find the cost of 1.8 pounds of cheese that sells for $3.98 per pound.
3. If $3\frac{1}{4}$ yards of material costs $23.40, what does 2 yards of the same material cost?
4. The store advertised 3 lemons for $1.08. How much would 10 lemons cost?
5. How many ounces are in $3\frac{1}{2}$ pounds?
6. If the ratio of yellow paint to green paint in a mixture is 5:2, how much yellow paint is needed to mix with 10 gallons of green paint?
7. 18 is 40% of what number?
8. 25 is what percent of 125?

Create four problems of your own that can be solved by using ratio and proportion. Choose two problems for the class to solve.

PCM 18

The Italian Restaurant

Read the problem. Review the list of possible problem-solving methods. Then choose at least one method and use it to solve the problem.

A local Italian restaurant can seat 82 customers at 25 tables. Some are tables for 2, and the others are tables for 4. When I arrived at the restaurant at 6:30, I was told that the place was full and that I would get the next available table. I wondered if the table would be for 2 or for 4. How many tables for 2 and how many tables for 4 are in the restaurant?

Possible Problem-Solving Methods

- Guess and check.
- Draw a picture or diagram.
- Make a chart/look for a pattern.
- Make a list of possibilities.
- Use reasoning and arithmetic.
- Use an equation.
- Write two equations and use substitution.

Did you consider speed, accuracy, and reliability when choosing a method?

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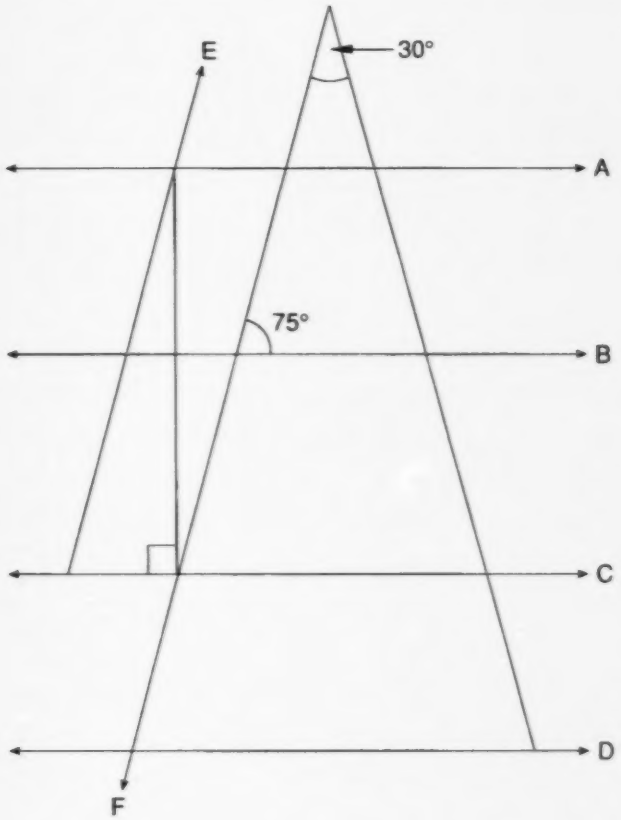
PCM

19 Putting It All Together

Find as many of the angles in the diagram as you can and label them with their measurements. Use facts 1–5 below and the measurements given on the diagram.

Lines A, B, C, and D are parallel.

Lines E and F are parallel.



1. When a straight line intersects parallel lines, corresponding angles are equal. Corresponding angles are at similar places on the straight line that intersects the parallel lines.

2. Vertical angles are equal.

3. Complementary angles add up to 90°.

4. Supplementary angles add up to 180°.

5. The three angles of a triangle add up to 180°.

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20 At the Machine Shop

Use your knowledge of common measurements to solve the following problems.

1. How many 1-inch strips can be cut from metal bars of the following lengths:
   a. 5 feet
   b. 8 yards
   c. $3\frac{1}{2}$ yards
   d. 2 feet 7 inches

2. A coil of wire can be extended $2\frac{1}{2}$ miles. How far is that in feet? In yards?

3. How many 7-millimeter lengths are in a section of steel 133 centimeters long?

4. The horizontal distance between two holes on a metal part is 3.5 centimeters less than a meter. What is the distance between the holes in centimeters?

5. A measurement on a blueprint is shown as 18 inches. What is this length in
   a. feet?
   b. centimeters?
   c. millimeters?

6. A plate $\frac{1}{2}$ foot thick will have $\frac{1}{4}$ inch milled off each side. How thick will the finished plate be in inches?

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PCM
21 Properties Worksheet

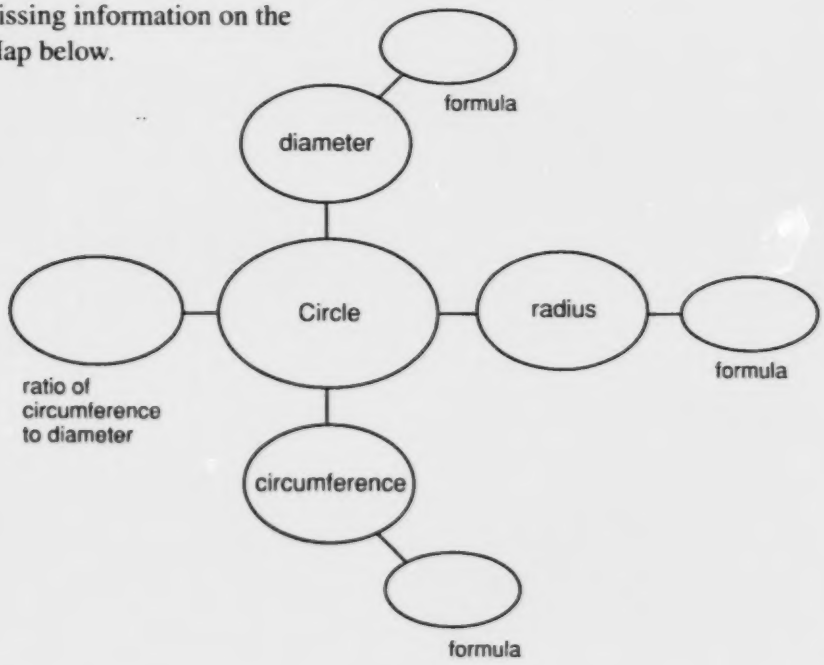
Complete the following problems about the properties of all figures like the one at the right.

1. Name the figure. _____

2. Give a definition of the figure. _____

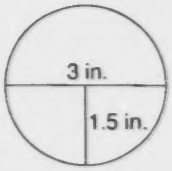
_____

3. Fill in the missing information on the Attributes Map below.



4. **a.** This is an example of a circle because _____

_____

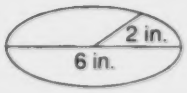


b. This is an example of a circle because _____

_____

5. This is a not an example of a circle because _____

_____



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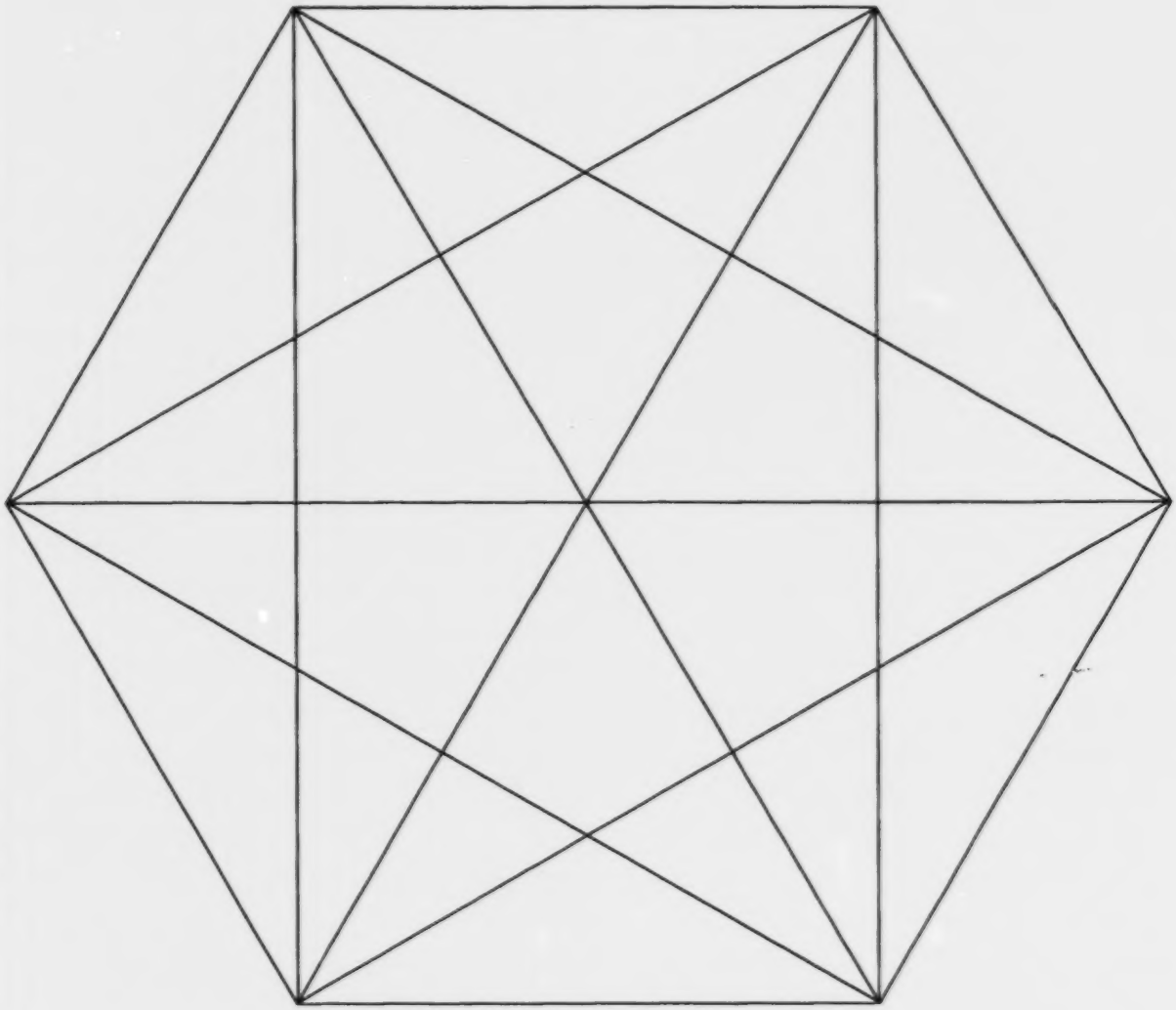
22

How Many Triangles Do You See?

Find and count as many triangles as you can in the figure below.



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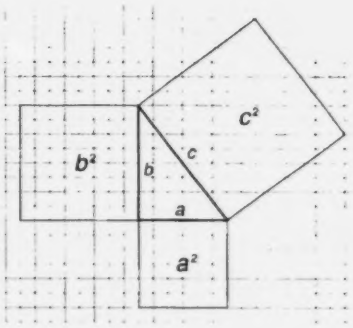
23 Investigating the Pythagorean Theorem

Use the following figures to learn more about right triangles and the Pythagorean theorem.

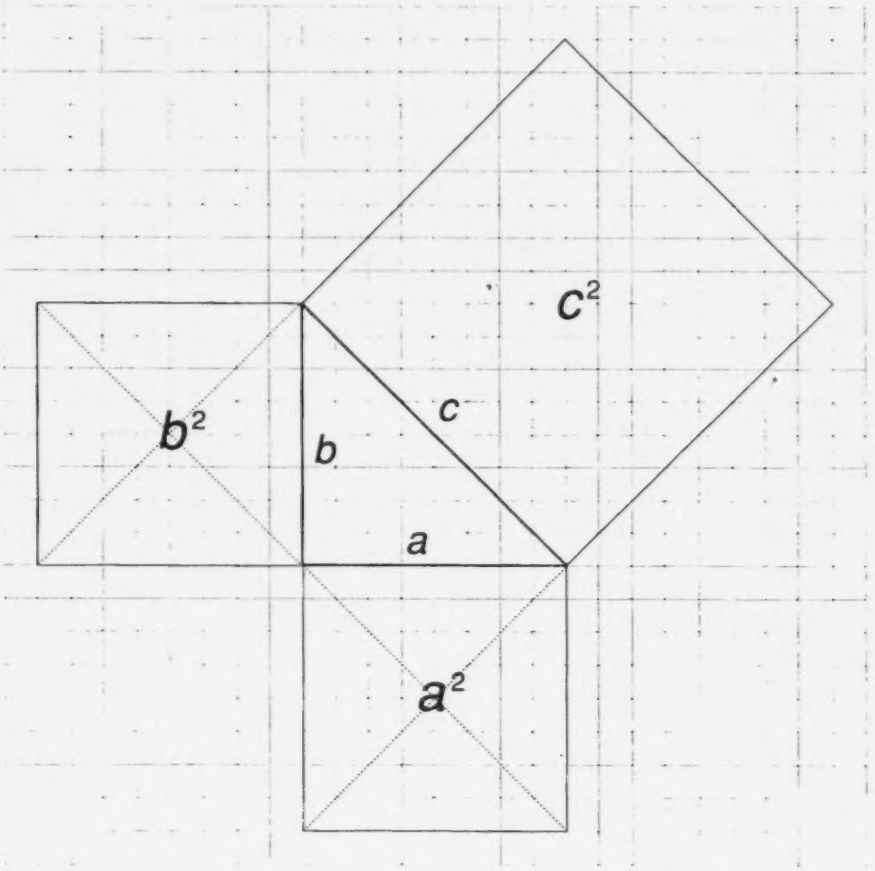


Pythagorean theorem: $c^2 = a^2 + b^2$ where c is the hypotenuse of a right triangle and a and b are the legs

The isosceles right triangle below is shown as an example.

- **Draw an isosceles right triangle and the accompanying square for each side.**
- **Cut the two squares a^2 and b^2 into four triangles each, for a total of eight smaller triangles.**
- **Arrange these triangles on the c^2 region to form a square.**

Does the sum of the areas of the squares of sides a and b equal the area of the square of side c?



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PCM 24

Maps

Using your map and ruler, follow these steps and answer the questions.

1. Locate the legend on your map. What is the scale? _____

2. **a.** Select two locations on your map that are connected by a fairly straight road. Use a ruler and the scale to find the actual distance between the two locations. Record the distance. _____

   b. How does the distance you found compare to the mileage markers on the map along the route?

   _____

3. Select three locations that are fairly far apart. Sketch a triangle, using the three locations as the vertices of the triangle. Use the ruler and the scale to find the lengths of the sides of the triangle.

   a. Can your triangle be a right triangle? _____

   b. Can you prove that it is or is not a right triangle? Explain.

   _____

4. Discuss why it might be easier to use the Pythagorean theorem on a local map than on a state map.

5. Discuss how you can use ratio and proportion problem-solving techniques to find distances on a map.

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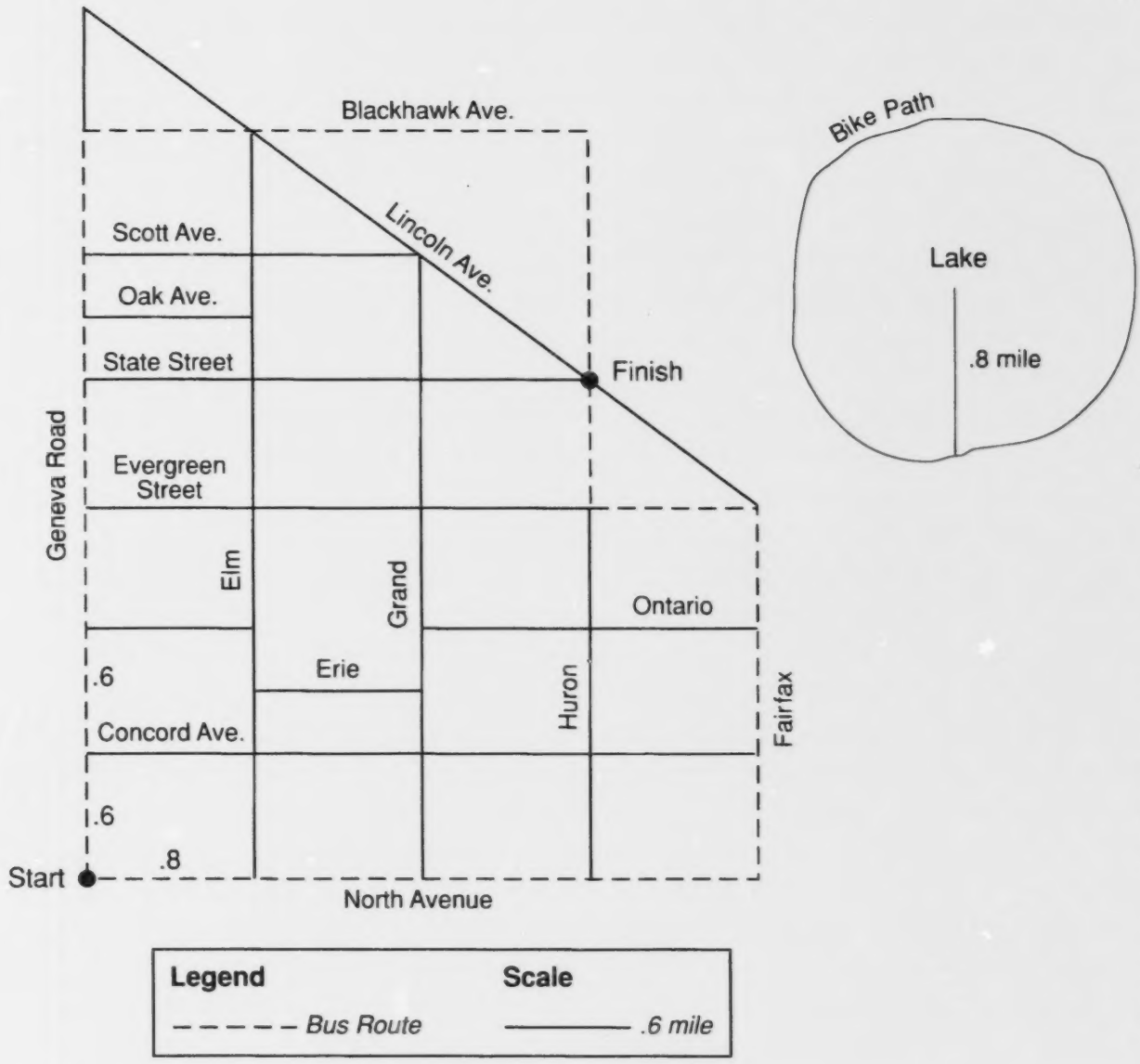
PCM 25

From Point A to Point B

Follow the directions given by your instructor. Use the map and the scale to find distances.



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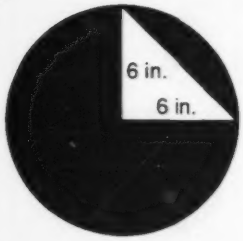
PCM

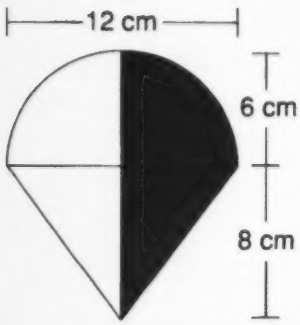
26 Made in the Shade

Choose any two figures and find the area of the shaded part of each.

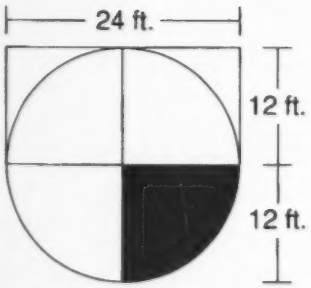
1.



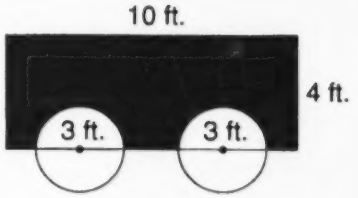
2.



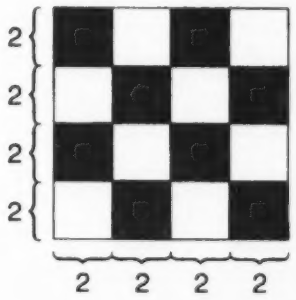
3.



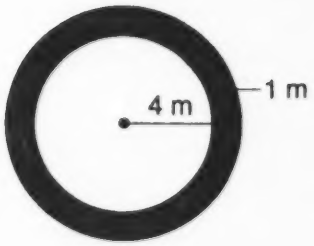
4.



5.



6.



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PCM 27

Using Formulas

Decide if each situation is a perimeter, area, or volume problem. In the chart below, place the problem number under the correct category, identify the figure described in the problem, and write the formula you will use. Then solve the problems.

1. How many feet of baseboard will you need for a workshop 26 feet long and 20 feet wide with a 3-foot door?

2. Find the volume of a toy box that is 4 feet long on each side.

3. How far will you jog if you run 8 laps around a circular trail that has a radius of 175 yards?

4. How many square feet of tile will you need to cover the floor of a room that is 15 feet by 25 feet?

5. How many feet of fencing will you need around a square garden 37 feet on each side?

6. How many cubic yards of asphalt are needed to lay a new walking path $\frac{1}{6}$ yard deep, 2 yards wide, and 780 yards long?

7. How many square inches of glass do you need to cover a square tabletop 18 inches on each side?

8. How many square feet of floor space will be covered by a circular rug that is 10 feet in diameter?

9. How many cubic feet of sand will it take to fill a sandbox that is 6 feet long, 4 feet wide, and 2 feet deep?

Perimeter			Area			Volume		
#	Figure	Formula	#	Figure	Formula	#	Figure	Formula

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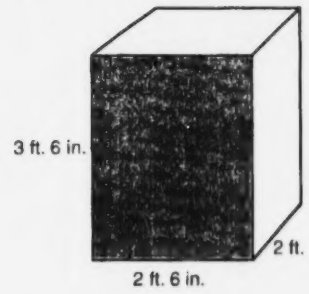
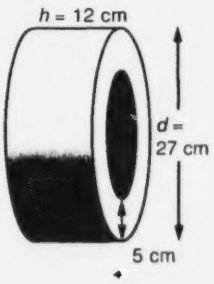
PCM
28 Geometric Figures

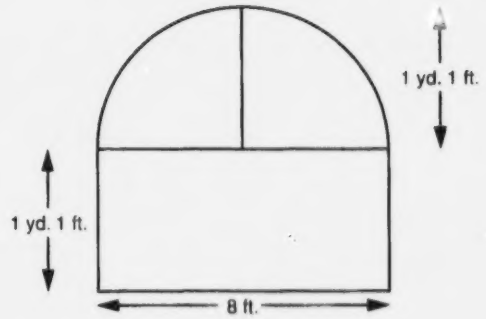
A.



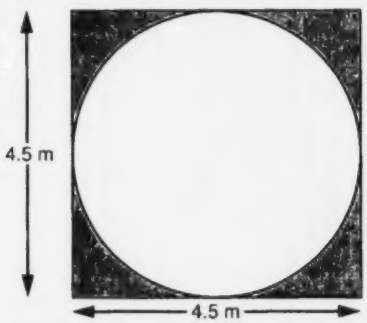
C.



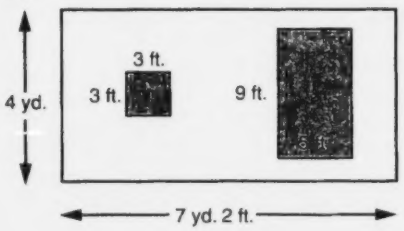
E.



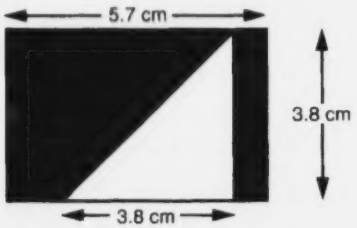
B.



D.



F.



PCM
29 Picture This

Use graph paper to complete the following problems:

1. Draw all possible rectangles with whole-number lengths and widths that have an area of 36 square units. Which rectangle has the largest perimeter? The smallest perimeter?

2. Draw all possible rectangles with whole-number lengths and widths that have a perimeter of 24 units. Which rectangle has the largest area? The smallest area?

3. Draw a circle inside a square measuring 8 units on each side. The circle should touch all four sides of the square. What is the area of the circle? What is the area of the square?

4. Draw a square inside a circle with a diameter of 8 units. All four corners of the square should touch the circle. What is the area of the square?

5. Draw a semicircle with a radius of 6 units. Draw a triangle inside the semicircle. All three corners of the triangle should touch the semicircle. What is the area of the largest triangle that can be drawn inside the semicircle?

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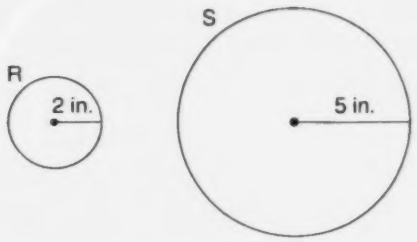
PCM

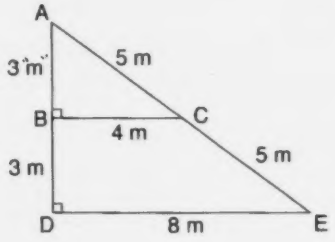
30 Investigating Similar Figures

Investigate the relationships between the shapes, dimensions, perimeters, and areas of each set of similar figures.

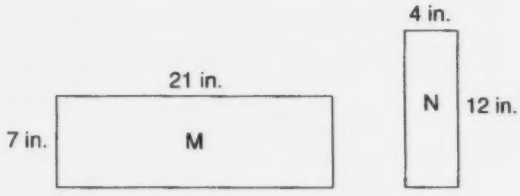
1. **a.** Do figures R and S have the same shape?
   b. Find the ratio radius of R:radius of S.
   c. Find the ratio circumference of R:circumference of S.
   d. Find the ratio area of R:area of S.



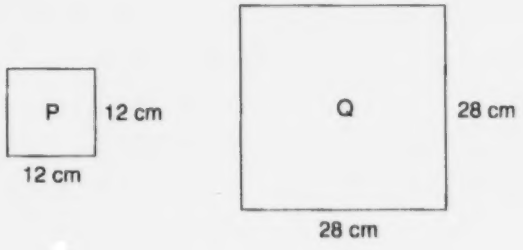
2. **a.** Do figures ABC and ADE have the same shape?
   b. Find the ratio AB:AD.
   c. Find the ratio BC:DE.
   d. Find the ratio perimeter of ABC:perimeter of ADE.
   e. Find the ratio area of ABC:area of ADE.



3. **a.** Do figures M and N have the same shape?
   b. Find the ratio width of M:width of N.
   c. Find the ratio length of M:length of N.
   d. Find the ratio perimeter of M:perimeter of N.
   e. Find the ratio area of M:area of N.



4. **a.** Do figures P and Q have the same shape?
   b. Find the ratio side of P:side of Q.
   c. Find the ratio perimeter of P:perimeter of Q.
   d. Find the ratio area of P:area of Q.



5. Make a statement about the relationship between the ratio of the dimensions and the ratio of the perimeters. Make another statement about the relationship between the ratio of the dimensions and the ratio of the areas. Check your statements on a few figures of your own.

_____

_____

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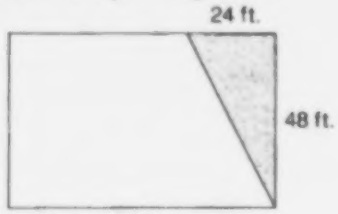
31 The Garden

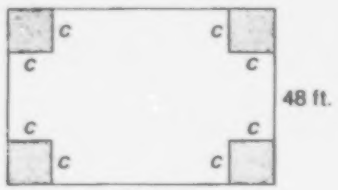
Suppose you've been asked to develop plans to plant flowers in a yard that is 72 feet by 48 feet. The only requirement is that the flowers must occupy an area close to 576 square feet. Some sample designs are shown below. The shaded areas are planting areas.

Use your calculator and knowledge of geometry to find the dimensions and perimeter of each planting area. Then design your own planting area.

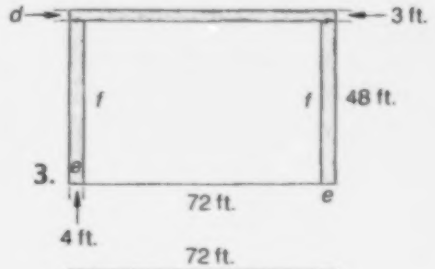
1.



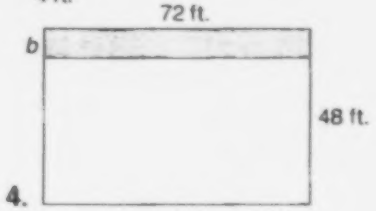
2.



3.



4.



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32 Working with Figures

Follow these directions for all the problems: Sketch and label an appropriate figure, write an equation, and find the missing measurements. For problems 1–4, let x be the smallest missing measurement.

1. Find the length and width of a rectangle with a length 3 units longer than the width and a perimeter of 26 units.
2. Find the measurements of the three angles of an isosceles triangle if each of the equal angles is twice the size of the vertex angle.
3. Find the measurements of two complementary angles if one angle is three times the size of the other angle.
4. Find the measurements of the three angles of a triangle if they have a ratio of 1:2:3.
5. Find the measurements of two supplementary angles that have a ratio of 4:5. Let $4x$ be the smaller angle.

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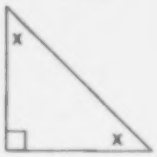
33 Matching Set-Up Solutions

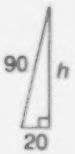
On the lines provided, write the set-up solution on the right that matches that figure.
Remember: area = *A*, circumference = *C*, and perimeter = *P*.

1. *A* = _____

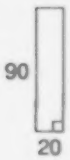
2. x = _____



3. *h* = _____

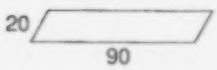


4. *A* = _____

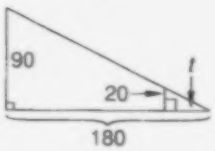


5. y = _____

6. *P* = _____

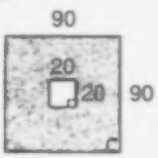


7. *t* = _____

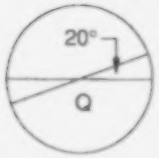


8. *C* = _____

9. *A* (shaded) = _____



10. Q = _____



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a. $\frac{180 - 90}{2}$

b. $180 - 90 - 20$

c. $\frac{180(20)}{90}$

d. $180 - 20$

e. $\sqrt{90^2 - 20^2}$

f. $2(20)\pi$

g. $90^2 - 20^2$

h. $\pi(20)^2$

i. $90(20)$

j. $2(90 + 20)$

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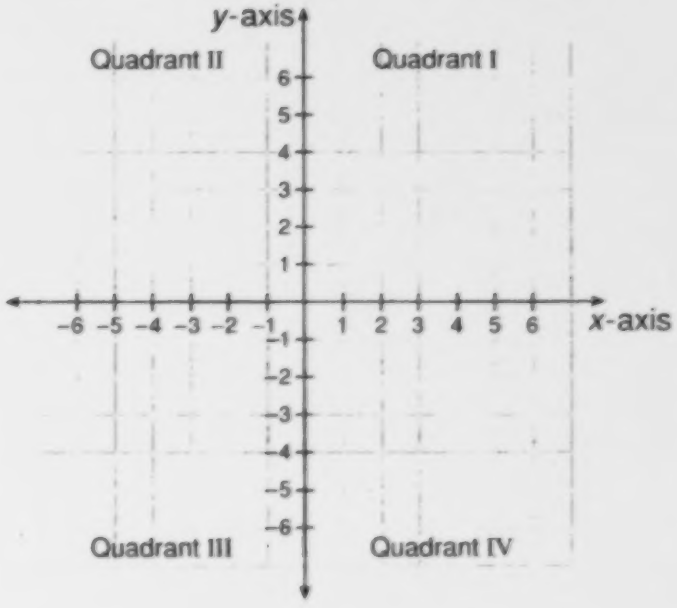
34 Plotting Points and Finding Distances

A. Plot the following points. Be sure to label them.

A (0,4)	H (–3,1)
B (–4,0)	I (3,3)
C (2,–2)	J (0,–1)
D (–4,–4)	K (0,0)
E (–5,2)	L (–2,–2)
F (4,5)	M (2,1)
G (5,–4)	N (4,1)



B. Find the distance between each pair of points.

1. A and K _____
2. A and J _____
3. L and C _____
4. B and D _____
5. D and G _____
6. M and C _____
7. M and N _____
8. H and M _____
9. F and N _____
10. K and B _____

C. The coordinate system consists of four quadrants, the *x*-axis, and the *y*-axis. Look for patterns in the coordinate system.

Describe what the points plotted in the following areas have in common. (*Hint:* Look at the points you plotted in Part A.)

11. quadrant I _____
12. quadrant II _____
13. quadrant III _____
14. quadrant IV _____
15. on the *x*-axis _____
16. on the *y*-axis _____
17. at the origin _____

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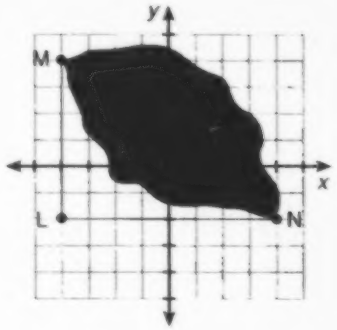
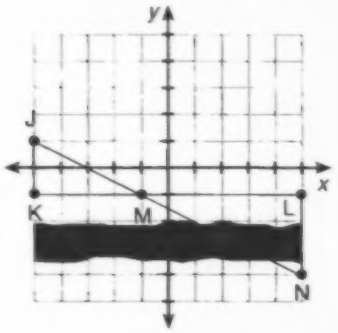
35 Geometric Investigations

Use your knowledge of geometric relationships to solve the following problems.

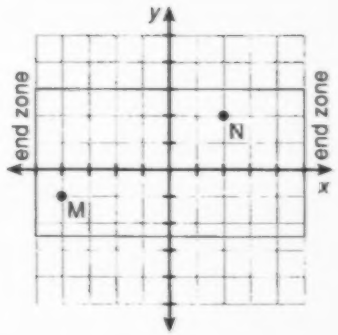
1. Describe how you could find the distance across the lake (from M to N) without measuring across the lake.



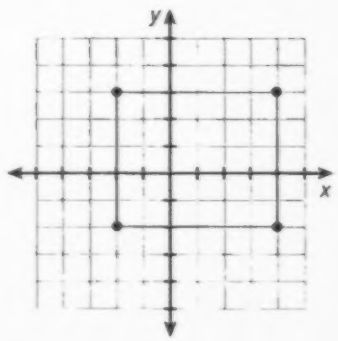
2. Describe how you could find the distance from M to N if you cannot measure across the river.



3. On the football field, the quarterback N passed the football to the receiver M, who ran the last 10 yards for a touchdown. How long was the pass? (*Note:* The space between lines represents 10 yards.)



4. Find the area of the largest circular swimming pool that can be put on this plot of land. Each unit in the coordinate system represents 3 feet.



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36 Tables, Patterns, and Graphs

Read each situation below. Fill in the tables to show the relationship between the values being discussed. Then write an equation using x and y that reflects the pattern in the table. Finally, graph all equations on the coordinate system provided.

Note: Remember that two points determine a line.

1. The local grocery store mailed $5-off coupons to all of its customers. What is the relationship between the value of the purchase (x) and the amount paid for the purchase (y)?

x	y
8	3
14	
5	

2. What is the relationship between the radius (x) of a circle and the diameter (y) of a circle?

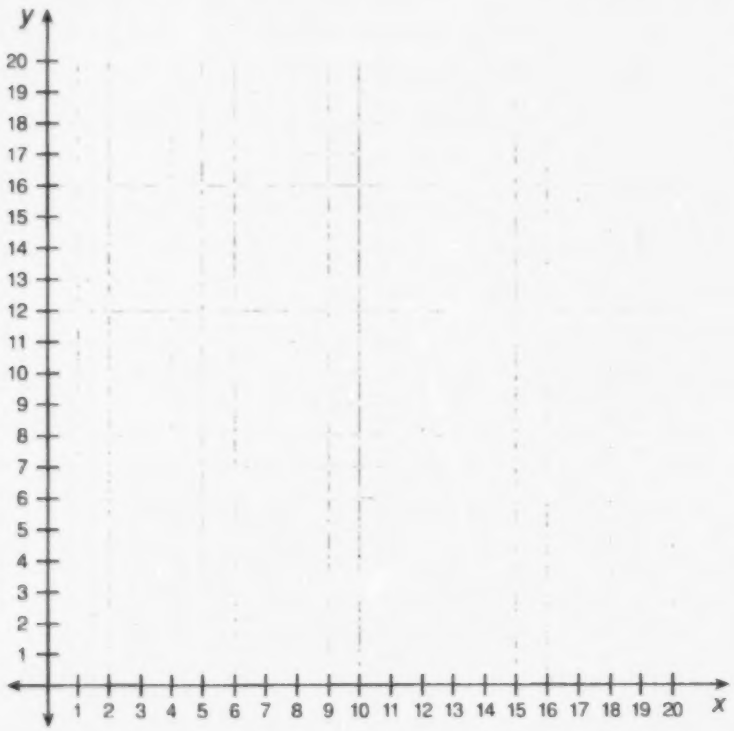
x	y
3	
	12
7	

3. What is the relationship between the perimeter (y) of a square and the side (x) of a square?

x	y
2	
	16
	20

4. If I always pay my lunch bill (x) with a $10 bill, how can I explain how much change (y) I get each day?

x	y
$4	
	$5
	$3



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37 Is a Picture Worth a Thousand Words?

Match each graph with the correct equation.

_____ **1.** $y = 4$

_____ **2.** $y = \frac{1}{2}x + 1$

_____ **3.** $y = x + 3$

_____ **4.** $y = -2x + 4$

_____ **5.** $y = 2x - 1$

_____ **6.** $y = x$

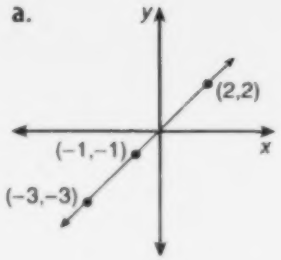
_____ **7.** $x = 2$

_____ **8.** $y = 5 - 3x$

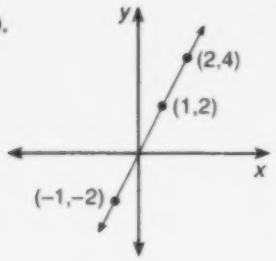
_____ **9.** $y = -x + 5$

_____ **10.** $y = 2x$

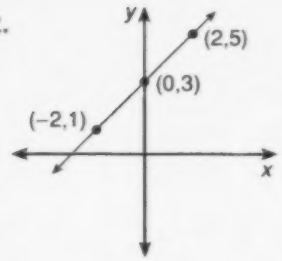
a.



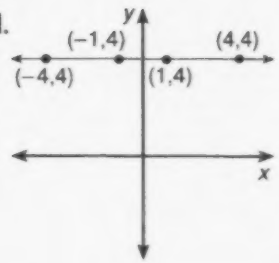
b.



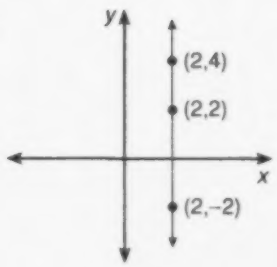
c.



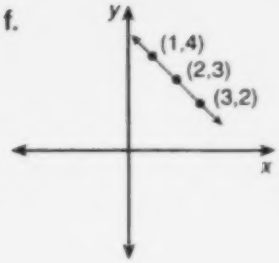
d.



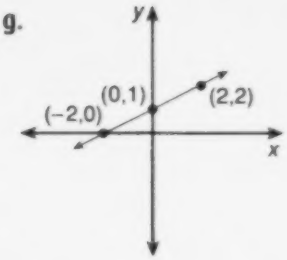
e.



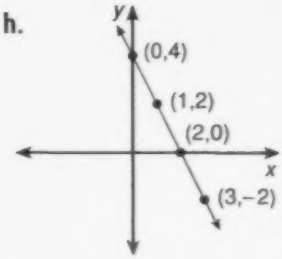
f.



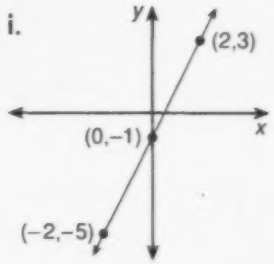
g.



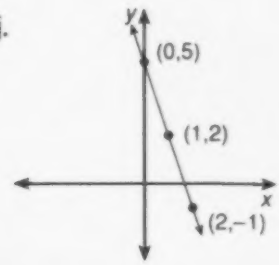
h.



i.



j.



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38 Linear Explorations

Read each situation and then solve the problems on a separate piece of paper.

Situation A

Suppose you are playing a game that involves flipping a coin. If the coin shows heads, you get 2 points. If it shows tails, you lose 3 points. Follow steps 1–6 to find the combinations of heads and tails that will yield a final score of 6 points.

1. If x is the number of times the coin showed heads, what expression represents the total number of points you scored when the coin showed heads?
2. If y is the number of times the coin showed tails, what expression represents the total number of points you lost when the coin showed tails?
3. Write an equation to find the combination of heads and tails that will yield a final score of 6 points.
4. Assign values to x (or y) and solve for the remaining variable. Write at least three solutions in a table.
5. Graph the equation.
6. What conclusions can you draw from your graph? What is the slope of the line? What does it mean?

Situation B

For each half hour at the amusement park, the average receipts at the Omnivision Theater are $120. Adults' tickets cost $4, and children's tickets cost $2. Find the combinations of adults' and children's tickets that will bring in $120 by following steps 7–11.

7. If x represents the number of children's tickets and y represents the number of adults' tickets, write an equation to find the combinations of adults' and children's tickets that yield $120.
8. Assign values for x (or y) and solve for the remaining variable. Write at least three solutions in a table and graph the equation.
9. What do the x-intercept and y-intercept tell you?
10. What is the slope of the line? What does it mean in this situation?
11. What conclusions can you draw from your graph?

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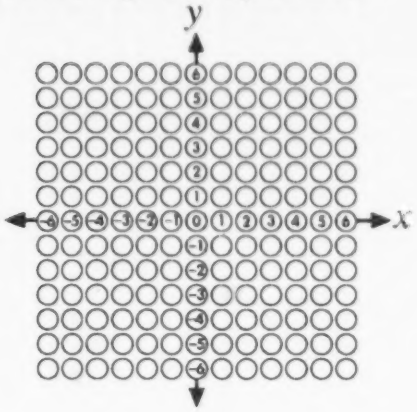
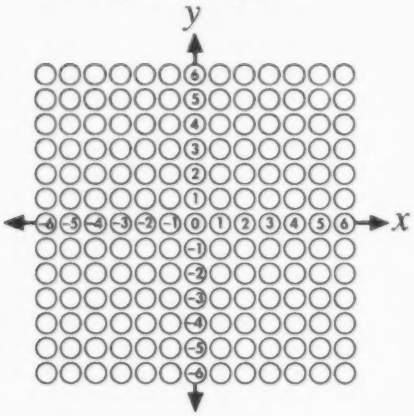
39 Plot the Missing Point

Find and plot the missing point needed to complete each figure.

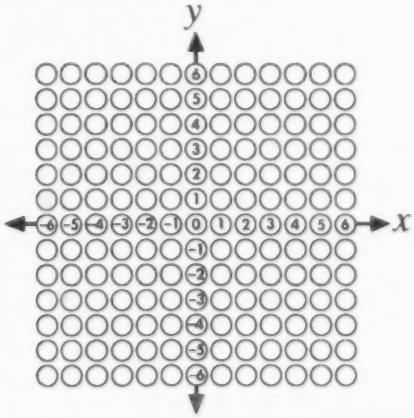
1. Vertices: (–3,3), (1,3), and (1,–1)
   Area of figure: 16 square units



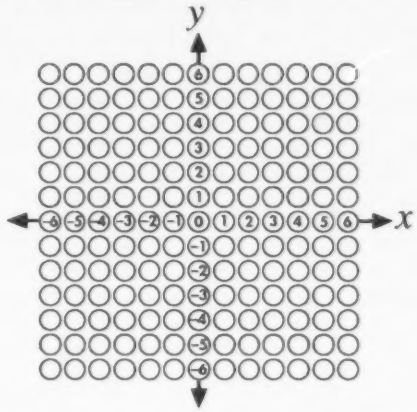
2. Vertices: (–5,5), (–5,–4), and (–3,–4)
   Area of figure: 18 square units



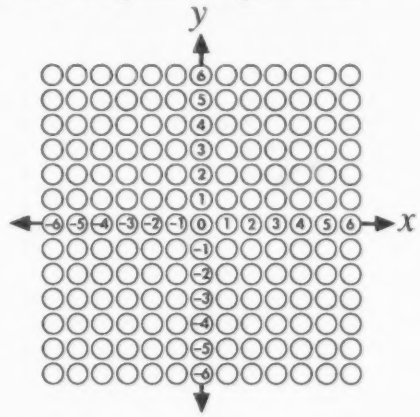
3. Vertices: (–1,0) and (–1,–5)
   Area of figure: 15 square units



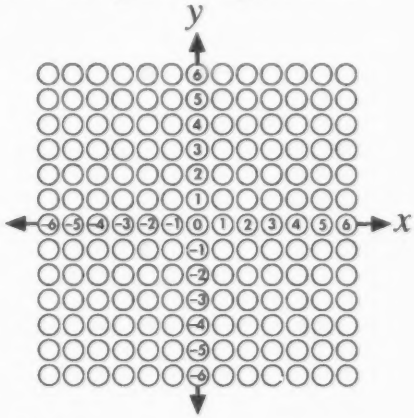
4. Vertices: (6,–5) and (2,3)
   Area of figure: 32 square units



5. Vertices: (–2,5), (–2,–2), and (–5,–2)
   Area of figure: 21 square units



6. Vertices: (–5,1), (–2,4), and (2,4)
   Area of figure: 12 square units



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Answer Key

PCM 1: List of Expressions

Addition

5. $84 + 85$
10. $\$8.75 + \$.88$
18. $\$32{,}000 + \$6{,}500$

Subtraction

1. $\$40 - \$12$
4. $\$103.68 - \$7.86$
11. $\$4{,}275 - \$3{,}500$
14. $\$20.00 - \$17.58$
20. $15 - \frac{7}{8}$

Multiplication

2. $6(\$5)$
6. $55\left(6\frac{1}{2}\right)$
9. $24(60)$
12. $2(\$18{,}000)$
16. $\frac{3}{4}(3{,}000)$

Division

3. $\frac{\$2{,}000}{5}$
7. $\frac{\$376}{4}$
8. $\frac{\$3.85}{12}$
13. $\frac{1{,}860}{65}$
15. $\frac{45}{2.5}$
17. $\frac{\$2{,}304}{\$256}$
19. $\frac{36}{4.5}$

PCM 3: Negative Numbers in Your Life

1. $-\$5.75 + \$2.80 = -\$2.95$ (or owed $2.95)
2. $-17 + 7 = -10$ (or 10 pounds lighter)
   $-10 - 12 = -22$ (or 22 pounds less)
3. $-2°F - 7°F = -9°F$
4. $-\$120 + \$56 = -\$64$ (a loss of $64)

PCM 4: Working with Signed Numbers

1. -5
2. 14
3. -16
4. 0
5. -50
6. 0
7. -41
8. -10
9. 96
10. -1
11. -19
12. 18
13. 16
14. -23
15. -36
16. -62
17. 2
18. -16

PCM 5: From the Specific to the General

Wording and real-life examples will vary.

- a number squared; n^2; the area of a square is equal to the length of one side squared.
- a number minus two; $n - 2$; a dieter's weight after losing two pounds in a week.
- two minus a number; $2 - n$; the temperature after dropping a number of degrees from 2°.
- a number plus two; $n + 2$; a family that had twins.
- a number divided by 2; $\frac{n}{2}$; any number of dollars divided equally between two people.
- two divided by a number; $\frac{2}{n}$; two pizzas divided equally among the number of people at a party.

PCM 6: Using Algebra to Describe Patterns

$n \cdot 0 = 0$ and $0 \cdot n = 0$

$nm = mn$

$n + m = m + n$

$n \cdot 1 = n$

$n + 0 = n$

$n \cdot \frac{1}{n} = 1$

$n \cdot n = n^2$

$n - n = 0$

$\frac{n}{n} = 1$

PCM 8: Find the Value

1. 50
2. 25
3. 264
4. 952
5. 630
6. 1,405
7. 12,800
8. 480
9. 22,400

PCM 9: Formulas in Your Life

1. Tasty Flakes: $0.0956 ≈ $0.10 per oz.
   Toasted Oats: $0.1075 ≈ $0.11 per oz.
   Honey Chunks: $0.179 ≈ $0.18 per oz.
   Corny Flakes: $0.127 ≈ $0.13 per oz.
   Tasty Flakes has the lowest unit price. Honey Chunks has the highest unit price.
2. Answers will vary.
3. $\frac{324}{18}$ = **18 miles per gallon**
4. Answers will vary.
5. $(\$6{,}500)(.09)(3) = \mathbf{\$1{,}755}$
6. Answers will vary.
7. $A = \frac{(127 + 167 + 198)}{3} = 164$
   $H = .8(200 - 164) = .8(36) = \mathbf{28.8}$
8. Answers will vary.

PCM 10: Extended Place Value Chart

1. 7.8×10^{-4}
2. 9.0×10^{-5}
3. 5.64×10^{-6}
4. 0.000027
5. 0.00934
6. 0.0006
7. $0.000000054 = 5.4 \times 10^{-8}$
8. $24{,}360{,}000{,}000 = 2.436 \times 10^{10}$
9. $7{,}130{,}000{,}000 = 7.13 \times 10^{9}$
10. $.000001593 = 1.593 \times 10^{-6}$

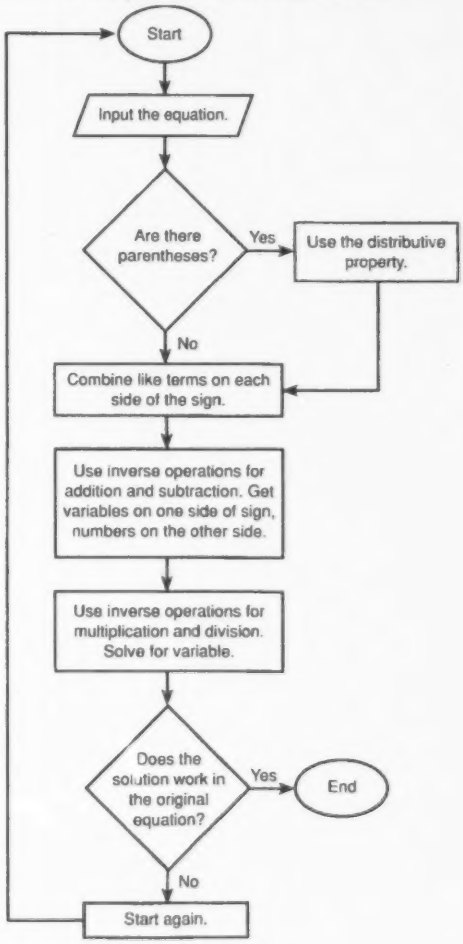
PCM 13: Clara's Cafe Sponsors a Softball Team

1. $28x - 20 = 316$ *or* $28x = 316 + 20$
   $x = \mathbf{12}$
2. $15x + 15 = 75$ *or* $75 - 15x = 15$
   $x = \mathbf{4}$
3. $2x + 6 = 24$ *or* $24 - 2x = 6$
   $x = \mathbf{9}$
4. $15x + 72 = 447$ *or* $447 - 15x = 72$
   $x = \mathbf{25}$
5. $6x + 22 = 80$ *or* $80 - 6x = 22$
   $x \approx \mathbf{9.67}$
6. Answers will vary.

PCM 14: A Step-by-Step Approach

1. $5 + 7 \times 8 - 3 = \mathbf{58}$
2. $5 + 7 \times (8 - 3) = \mathbf{40}$
3. $5 + 7^2 \times 8 - 3 = \mathbf{394}$

   A sample flowchart is shown here.


Start
Input the equation.
Are there parentheses?
Yes
Use the distributive property.
No
Combine like terms on each side of the sign.
Use inverse operations for addition and subtraction. Get variables on one side of sign, numbers on the other side.
Use inverse operations for multiplication and division. Solve for variable.
Does the solution work in the original equation?
Yes
End
No
Start again.

4. $5x - 15 = 2x$
   $x = \mathbf{5}$
5. $16 + 4z = 48$
   $z = \mathbf{8}$
6. $3(n + 2) - 6 = 27$
   $n = \mathbf{9}$

PCM 15: Retail Discounts

1. Selling price equals marked price minus discount.
2. Discount equals rate of discount times marked price.
3. Rate of discount equals discount divided by marked price.
4. Discount equals marked price minus selling price.
5. Marked price equals selling price divided by one minus rate of discount.

Item	Marked Price	Selling Price	Discount: Amount	Discount: Rate
Dress	$36.00	$28.80	$7.20	20%
Shoes	$27.50	$21.45	$6.05	22%
Sport coat	$70.00	$61.25	$8.75	12.5%
Sweater	$39.95	$27.96	$11.99	30%
Shirt	$17.75	$13.35	$4.40	24.8%
Coat	$280.00	$238.00	$42.00	15%
Suit	$200.00	$168.00	$32.00	16%
Jewelry	$92.00	$50.60	$41.40	45%

PCM 17: Using Ratio and Proportion

1. $\frac{826 \text{ bricks}}{14 \text{ feet}} = \frac{n \text{ bricks}}{35 \text{ feet}}$

   $n = \frac{826 \times 35}{14} = \mathbf{2{,}065 \text{ bricks}}$
2. $\frac{\$3.98}{1 \text{ lb.}} = \frac{\$n}{1.8 \text{ lb.}}$

   $n = \frac{3.98 \times 1.8}{1} = \mathbf{\$7.16}$
3. $\frac{\$23.40}{3\frac{1}{4} \text{ yd.}} = \frac{\$n}{2 \text{ yd.}}$

   $n = \frac{23.40 \times 2}{3\frac{1}{4}} = \mathbf{\$14.40}$
4. $\frac{3 \text{ lemons}}{\$1.08} = \frac{10 \text{ lemons}}{\$n}$

   $n = \frac{10 \times 1.08}{3} = \mathbf{\$3.60}$
5. $\frac{16 \text{ oz.}}{1 \text{ lb.}} = \frac{n \text{ oz.}}{3\frac{1}{2} \text{ lb.}}$

   $n = \frac{16 \times 3\frac{1}{2}}{1} = \mathbf{56 \text{ ounces}}$
6. $\frac{5 \text{ yellow}}{2 \text{ green}} = \frac{n \text{ gallons yellow}}{10 \text{ gallons green}}$

   $n = \frac{5 \times 10}{2} = \mathbf{25 \text{ gallons yellow}}$

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7. $\frac{18 \text{ part}}{n \text{ whole}} = \frac{40\%}{100\%}$

$n = \frac{18 \times 100}{40} = \mathbf{45}$

8. $\frac{25 \text{ part}}{125 \text{ whole}} = \frac{n\%}{100\%}$

$n = \frac{25 \times 100}{125} = \mathbf{20\%}$

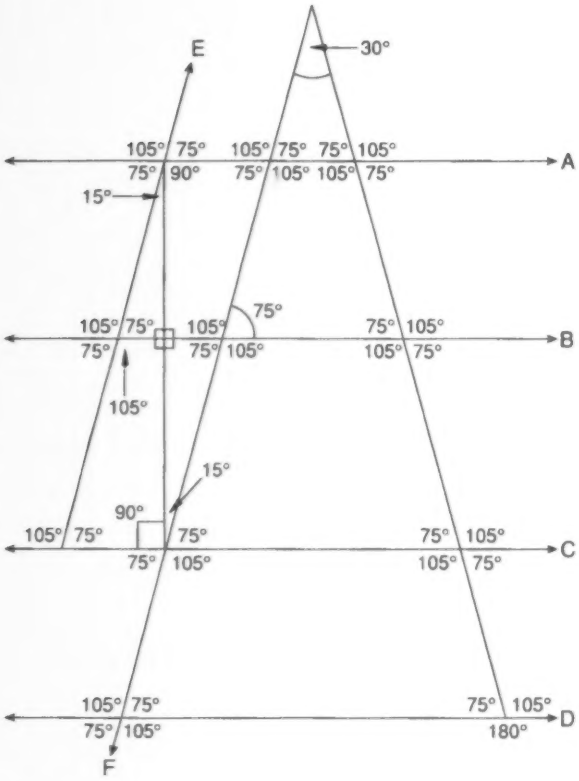
PCM 18: The Italian Restaurant

16 tables (4 per table) = 64 customers

9 tables (2 per table) = 18 customers

25 tables 82 customers

PCM 19: Putting It All Together



PCM 20: At the Machine Shop

1. a. 60 c. 126
   b. 288 d. 31
2. 13,200 feet; 4,400 yards
3. 190
4. 96.5 centimeters
5. a. $1\frac{1}{2}$ feet
   b. 45.72 centimeters
   c. 457.2 millimeters
6. $5\frac{1}{2}$ inches

PCM 21: Properties Worksheet

1. circle
2. a closed set of points in a plane where every point on the figure is the same distance from the center
3. diameter formula: $2r$

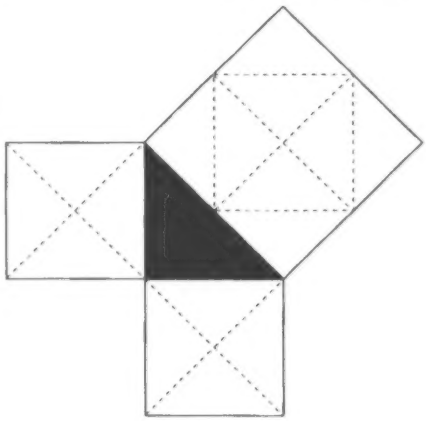
   radius formula: $\frac{1}{2}d$

   circumference formula: πd or $2\pi r$

   ratio of circumference to diameter: π
4. a. the diameter is twice the length of the radius

   b. all points on the circle are the same distance from the center; the radii are equal
5. the diameter is not twice the length of the radius; the shape is an oval

PCM 23: Investigating the Pythagorean Theorem



PCM 24: Maps

Answers will vary depending on the maps used. Some general guidelines are given here for questions 4 and 5.

4. The streets on a local map are more likely to be perpendicular.
5. The ratio can be calculated from the length of the scale if it's not stated. By setting up an equivalent ratio using the distance you have measured on the map, you can write a proportion and then solve for the missing actual distance.

PCM 25: From Point A to Point B

1. Shortest route: .24 + .24 = **.48 mile**
2. Bike path: 5.024 miles
3. Bus route: .8(8) + .6(12) = 6.4 + 7.2 = **13.6 miles**
4. Blackhawk and Elm to Finish: $1.6^2 + 1.2^2 = c^2$

   $2.56 + 1.44 = c^2$

   $\sqrt{4} = c$

   $c =$ **2 miles on Lincoln Avenue**

PCM 26: Made in the Shade

1. $\pi r^2 = \pi 6^2 = 113.04$

   $\frac{1}{2}bh = \frac{1}{2}(36) = 18$

   $113.04 - 18 =$ **95.04 in.^{2}**

2. $\frac{\left(\frac{1}{2}bh + \frac{1}{2}\pi r^2\right)}{2} = \frac{\left(\frac{1}{2} \cdot 12 \cdot 8 + \frac{1}{2} \cdot 3.14 \cdot 6^2\right)}{2} =$

   $\frac{(48 + 56.52)}{2} =$ **52.26 cm^2**

3. $\pi r^2 = \pi(144) = 452.64$

   $452.64 \div 4 =$ **113.04 ft.^{2}**

4. $lw - \pi r^2 = 40 - (3.14 \cdot 1.5^2) = 40 - 7.065 =$ **32.935 ft.^{2}**

5. $8(2^2) =$ **32 square units**

6. $25(3.14) - 16(3.14) =$ **28.26 m^2**

PCM 27: Using Formulas

Perimeter		
#	Figure	Formula
1	rectangle	$2l + 2w = P$
3	circle	$2\pi r = \pi d = C$
5	square	$4s = P$
Area		
#	Figure	Formula
4	rectangle	$lw = A$
7	square	$s^2 = A$
8	circle	$\pi r^2 = A$
Volume		
#	Figure	Formula
2	cube	$s^3 = V$
6	rectangular solid	$lwh = V$
9	rectangular solid	$lwh = V$

1. $2(26) + 2(20) - 3 = 52 + 40 - 3 = 92 - 3 =$ **89 feet**
2. $4 \cdot 4 \cdot 4 =$ **64 cubic feet**
3. $2(175) = 350$

   $3.14 \cdot 350 \cdot 8 =$ **8,792 yards**
4. $15(25) =$ **375 square feet**
5. $37(4) =$ **148 feet**
6. $\frac{1}{6} \cdot 2 \cdot 780 =$ **260 cubic yards**
7. $18^2 =$ **324 square inches**
8. $3.14(25) =$ **78.5 square feet**
9. $6 \cdot 4 \cdot 2 =$ **48 cubic feet**

PCM 29: Picture This

The widths and lengths for all possible rectangles in problems 1 and 2 are given in the charts below.

1. largest perimeter:
   $w = 1, l = 36$

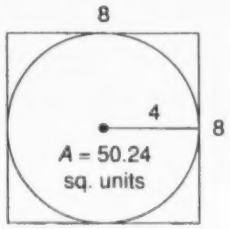
   smallest perimeter:
   $w = 6, l = 6$

w	l
1	36
2	18
3	12
4	9
6	6

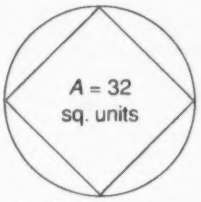
2. largest area:
   $w = 6, l = 6$

   smallest area:
   $w = 1, l = 11$

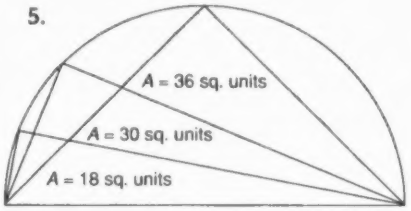
w	l
1	11
2	10
3	9
4	8
5	7
6	6

3. 

A = 64 sq. units

4. 

A = 50.24 sq. units

5. 

The triangle with the largest area should have one side along the diameter and a vertex at the midpoint of the half circle's arch.

PCM 30: Investigating Similar Figures

1. a. yes
   b. $\frac{2}{5}$
   c. $\frac{4\pi}{10\pi} = \frac{2}{5}$
   d. $\frac{4\pi}{25\pi} = \frac{4}{25}$

2. a. yes
   b. $\frac{3}{6} = \frac{1}{2}$
   c. $\frac{4}{8} = \frac{1}{2}$
   d. $\frac{12}{24} = \frac{1}{2}$
   e. $\frac{6}{24} = \frac{1}{4}$

3. a. yes
   b. $\frac{7}{4}$
   c. $\frac{21}{12} = \frac{7}{4}$
   d. $\frac{56}{32} = \frac{7}{4}$
   e. $\frac{147}{48} = \frac{49}{16}$

4. a. yes
   b. $\frac{12}{28} = \frac{3}{7}$
   c. $\frac{48}{112} = \frac{3}{7}$
   d. $\frac{144}{784} = \frac{9}{49}$

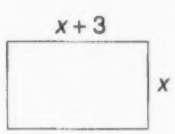
5. The ratio of the dimensions equals the ratio of the perimeters. The ratio of the area is the square of the ratio of the dimensions.

PCM 31: The Garden

1. Find the hypotenuse of the right triangle.
   $24^2 + 48^2 = 2{,}880$
   $a = \sqrt{2{,}880} \approx$ **54 feet**
   $P = 24 + 48 + 54 =$ **126 feet**
2. The four square planting areas are equal in size.
   $576 \text{ ft.}^2 \div 4 = 144 \text{ ft.}^2$
   $\sqrt{144} = 12$
   Each side measures **12 feet** and has 4 sides for a total of 16 sides.
   $P = 16(12) =$ **192 feet**
3. $f = 48 - d$
   $= 48 - 3$
   $=$ **45 feet**
   $P = 2(4) + 2(48) + 72 + 64 + 2(45) =$ **330 feet**
4. You know the area should be 576 square feet.
   $576 \div 72 = 8$
   The width of the rectangular planting area is **8 feet.**
   $P = 2(72) + 2(8) =$ **160 feet**

PCM 32: Working with Figures

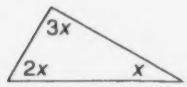
1. $2x + 2(x + 3) = 26$
   $2x + 2x + 6 = 26$
   $4x + 6 = 26$
   $4x = 20$
   $x =$ **5**
   $x + 3 =$ **8**



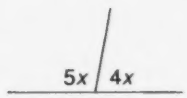
2. $x + 2x + 2x = 180°$
   Note: $x = 1x$
   $5x = 180°$
   $x =$ **36°**
   $2x =$ **72°**

3. $x + 3x = 90°$
   $4x = 90°$
   $x =$ **22.5°**
   $3x =$ **67.5°**

4. $x + 2x + 3x = 180°$
   $6x = 180°$
   $x =$ **30°**
   $2x =$ **60°**
   $3x =$ **90°**



5. $4x + 5x = 180°$
   $9x = 180°$
   $x = 20°$
   $5x =$ **100°**
   $4x =$ **80°**

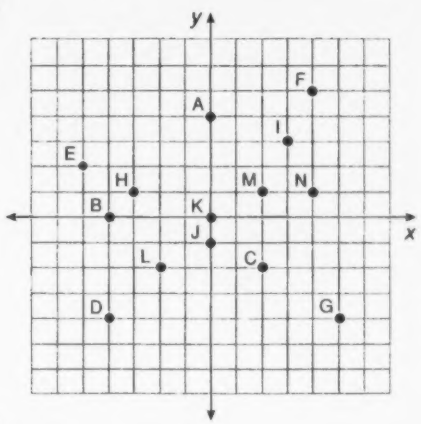


PCM 33: Matching Set-Up Solutions

1. **h.** $\pi(20)^2$
2. **a.** $\frac{180 - 90}{2}$
3. **e.** $\sqrt{90^2 - 20^2}$
4. **i.** $90(20)$
5. **b.** $180 - 90 - 20$
6. **j.** $2(90 + 20)$
7. **c.** $\frac{180(20)}{90}$
8. **f.** $2(20)\pi$
9. **g.** $90^2 - 20^2$
10. **d.** $180 - 20$

PCM 34: Plotting Points and Finding Distances

Part A



Part B

1. 4 units
2. 5 units
3. 4 units
4. 4 units
5. 9 units
6. 3 units
7. 2 units
8. 5 units
9. 4 units
10. 4 units

Part C

11. The points in quadrant I have positive x and y values.
12. The points in quadrant II have negative x values and positive y values.
13. The points in quadrant III have negative x and y values.
14. The points in quadrant IV have positive x values and negative y values.

15. Points on the x-axis have 0 as the y-coordinate.
16. Points on the y-axis have 0 as the x-coordinate.
17. The coordinates of the origin are (0,0).

PCM 35: Geometric Investigations

1. Use the Pythagorean theorem to find the hypotenuse MN of the triangle LMN.
2. Use similar figures and proportion to find MN. JKM and LNM are both right triangles with vertical angles.
3. $\sqrt{3^2 + 6^2} = \sqrt{9 + 36} = \sqrt{45}$

   $\sqrt{45} \approx 6.7$

   $6.7 \times 10 =$ **67 yards**
4. The largest possible diameter is 5 units, or 15 feet. Therefore, the largest possible radius is 2.5 units. That represents 7.5 feet. The area of the largest circular swimming pool that can be put on this plot is **176.625 square feet.**

PCM 36: Tables, Patterns, and Graphs

1. $x - 5 = y$

x	y
8	3
14	9
5	0

2. $2x = y$

x	y
3	6
6	12
7	14

3. $4x = y$

x	y
2	8
4	16
5	20

4. $\$10 - x = y$

x	y
\$4	\$6
\$5	\$5
\$7	\$3

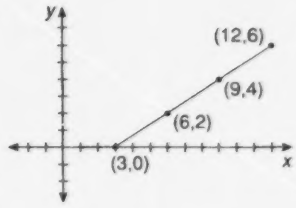
PCM 37: Is a Picture Worth a Thousand Words?

1. **d.**
2. **g.**
3. **c.**
4. **h.**
5. **i.**
6. **a.**
7. **e.**
8. **j.**
9. **f.**
10. **b.**

PCM 38: Linear Explorations

1. $2x$
2. $-3y$
3. $2x - 3y = 6$
4. Your table may vary.

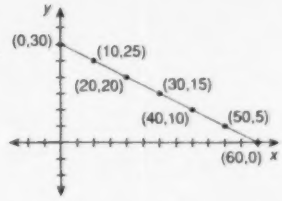
x	y
3	0
6	2
9	4
12	6

5. 

6. The number of heads must always outnumber the number of tails flipped to get a final score of 6 points. The slope is $\frac{2}{3}$. There is a positive relationship between the number of heads and tails needed. The more tails you get, the more heads you will need.
7. $2x + 4y = 120$
8. Your table may vary.

x	y
0	30
10	25
20	20
30	15
40	10
50	5
60	0

To plot these large numbers, let each space on the coordinate system represent 5.



9. The x-intercept tells how many children's tickets were sold if no adults' tickets were sold. The y-intercept tells how many adults' tickets were sold if no children's tickets were sold.
10. $-\frac{1}{2}$; The more that one kind of ticket was sold, the less of the other kind of ticket was sold.
11. The more adults' tickets sold, the fewer children's tickets were sold and vice versa. It takes twice as many children's tickets to yield \$120.

PCM 39: Plot the Missing Point

1. (–3,–1)
2. (–3,5)
3. (5,–5) or (5,0) or (–7,0) or (–7,–5)
4. (–2,–5)
5. (1,5) or (–5,5)
6. (–1,1)

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